BUREAU OF HYGIENE AND TROPICAL DISEASES.

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UNDULANT FEVERS.

ASHFORD (M.) & QUINNELL (Earle). **Undulant Fever in Territory of Hawaii.**—*Milit. Surgeon.* 1930. Nov. Vol. 67. No. 5. pp. 617–620.

So far no cases of undulant fever have been reported in Hawaii although the dairy herds there are known to be infected with *Br. abortus.* The authors tested the sera of some 600 people, many of whom were employed in dairies, but none gave a positive reaction with *Br. abortus.*

A case of infection is reported, in a lady, aged 30, the wife of an officer who had lived for about a year in Oahu, Hawaii; for a month or two before the birth of her child and during lactation she drank large quantities of unboiled cow's milk; in December 1929 fleeting joint pains were complained of and fever developed in January. Several recurrences of fever took place up till May when the patient became convalescent. On April 17 a serum test was made with *Br. abortus* and in 24 hours agglutination was shown in all dilutions up to 1-2,500. Blood cultures were not successful and no other source of infection than the raw cow's milk could be traced.

D. Harvey.

MASSELOT (F.). Notes sur quatre vingts cas de fièvre de Malte observés à l'Hôpital Français. [**Notes on 80 Cases of Undulant Fever observed in the French Hospital in Tunis.**]—*Tunisie Méd.* 1930. Nov. Vol. 24. No. 9. pp. 321–329.

These 80 cases were in Europeans admitted to the Hospital during the ten years from 1920–1930. In 24 cases the temperature curve was of the typical or undulant type, in 43 it was remittent or intermittent and in 11 it resembled closely the chart of typhoid fever. In the majority the duration was prolonged, "maladie interminable." In one case the picture was that of rheumatic fever with acute pain, swelling and redness of the joints, but there was a positive Widal agglutination reaction of over 1-200 with *Br. melitensis.* Three

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patients had definite signs of septicaemia; all showed a purpuric eruption and in one there was haemorrhage from the bowel and haematuria. The author is of opinion that an attack of undulant fever has no influence on tuberculosis; as he puts it, melitensis is neither the friend nor the enemy of the bacillus of Koch; it is neutral. For differentiation between undulant fever and tubercle he relies principally upon a careful and accurate X-ray examination of the chest and on sero-diagnosis; the latter should not be accepted as diagnostic of undulant fever unless the reaction is positive in 1-200 or higher dilution. The intradermal reaction of Burnet he has not found so useful since it may be positive in definite cases of tubercle.

As regards treatment neither protein therapy nor injection of antiseptics, such as urotropine or trypaflavine, have been of any avail. Vaccine therapy by intracutaneous or intramuscular route has been of no use in his hands; in 3 cases the intravenous injection of vaccine was a brilliant success but in many other cases it failed and the author has abandoned this method of therapy by reason of the severe reactions and the impossibility of forecasting when they will appear. In two cases treated by vaccine, in one the fever ceased but severe pains in joints appeared, in the other the pains disappeared but fever continued. The therapeutic injection of melitene was also in his hands a failure.

D. H.

HUDDLESON (I. Forest). Etude sur les infections à *Brucella* observées à Tunis et à Malte. [**Brucella Infections observed in Tunis and Malta.**]—*Arch. Inst. Pasteur de Tunis.* 1930. Dec. Vol. 19. No. 4. pp. 391–421. With 3 figs. [8 refs.] [Summary appears also in *Bulletin of Hygiene.*]

Much of the material in this article has already been published elsewhere; a number of observations, however, made by the author during his visit to Malta and Tunis, are put on record for the first time. A comparison was made between the value for blood culture of the usual veal infusion broth pH 7·2 and liver extract broth pH 6·6. Using veal broth, 4 out of 15 cultures proved positive, while with liver broth 14 out of 17 cultures, from the blood of the same series of patients, proved positive. Evidence was obtained that cultures were more frequently positive during a febrile attack than during an apyrexial interval. Stress is laid on the necessity of prolonged incubation of blood cultures; in two instances growth did not occur for 12 and 15 days respectively. As regards the serological diagnosis of undulant fever, it is stated that *Br. abortus* is now being used as an antigen in several Mediterranean laboratories in place of *Br. melitensis.* Cultures of *melitensis* frequently become rough; in this stage, besides being agglutinated only slightly by specific sera, they prove relatively susceptible to agglutination by normal sera. It is partly, perhaps, due to the use in the past of more or less rough cultures of *melitensis* that the agglutinin titres in cases of undulant fever have so often been low; the author finds that, when tested with an *abortus* antigen, sera from cases of *melitensis* infection react in comparatively high dilutions.

Burnet's intradermal test in diagnosis was apparently not found very reliable, some definite cases failing to react.

Comparison of undulant fever in the Mediterranean countries, due to *Br. melitensis*, with undulant fever in the U.S.A., due to the bovine and porcine types of *Br. abortus*, shows that the former disease lasts longer, is more frequently acute, has a higher case mortality, and is more often complicated by severe arthritis or orchitis.

G. S. Wilson.

MEDULLA (Candido). Sulla frequenza della febbre melitense in Cirenaica. [**Undulant Fever in Cyrenaica.**]—*Arch. Ital. Sci. Med. Colon.* 1931. Mar. 1. Vol. 12. No. 3. pp. 187–191. English summary (7 lines).

Undulant fever, though far from common, does undoubtedly occur. Thirty-six cases have been noted in the last 8 years ; in 1925–26 there were none, and the highest number in any single year was 18 in 1929. Six of these were European civilians (3 men, 3 women), 12 were white soldiers. All were in the Colonial Hospital, Benghazi, and, judging from the small number of patients, the chief district infected is Benghazi-Barce-Tolmetta. In the following year there were seven cases, again all Europeans and in the same district. The local goats are believed to be infected. Enquiries as to the *abortus* infection brought the replies that epidemic abortion is not known in the flocks or herds.

H. H. S.

LEVIN (William). **The Intradermal Test as an Aid in the Diagnosis of Undulant Fever.**—*Jl. Lab. & Clin. Med.* 1930. Dec. Vol. 16. No. 3. pp. 275–281. [16 refs.] [Hyg. Lab., State Board of Health, & Med. School, Univ. of Oregon, Portland.]

A heat-killed saline suspension of *Br. abortus* was first employed in the author's tests. In persons recently recovered from undulant fever this antigen gave unpleasantly severe results, and an attempt was made to produce one less toxic.

Br. abortus was grown on liver agar, washed off in saline and spun down, the supernatant fluid was decanted and the bacterial bodies again washed three times in 50 per cent., 95 per cent. and absolute alcohol. The washed bacterial cells were then extracted with absolute alcohol in a Soxhlet apparatus for two days, then with ether for two days. After the final extraction the bacterial cells were dried and thoroughly ground in an agate mortar, and finally suspended in saline.

A large number of tests were carried out on known and suspected cases of undulant fever and also on tuberculous subjects and normal people. In all 365 individuals were given the intradermal test. Twenty-seven gave distinctly positive reactions ; of these fifteen were definite cases of undulant fever with positive agglutination tests ; six were people who had had undulant fever two years previously. Four who reacted gave negative agglutination tests and no history of undulant fever or contact with *abortus* infection.

The author concludes that the intradermal test promises to be of distinct diagnostic aid to the clinician and merits serious consideration. It may be of use also in cases where agglutination is negative.

D. H.

BROC. Note sur les relations entre la fièvre méditerranéenne et la tuberculose. [**Relation between Undulant Fever and Tuberculosis.**] —*Tunisie Méd.* 1930. Apr. Vol. 24. No. 4. pp. 157–160.

The author has seen several cases of undulant fever with a positive agglutination of 1-10 to 1-100, in which there were signs and symptoms of early phthisis and subsequent development of that disease. He asks, were these true cases of undulant fever lighting up a tuberculous focus or did the tuberculous process simulate undulant fever ? Cases have been also noted of tuberculous patients who gave a positive reaction to *Br. melitensis*, but no history of an attack of undulant fever. In all such cases blood culture and X-ray examinations should be employed as aids to diagnosis.

D. H.

BEVAN (Ll. E. W.). **Blood Culture in Undulant Fever.** [Correspondence.]—*Brit. Med. Jl.* 1930. Aug. 16. p. 267.

Dr. Bevan refers to a letter of Dr. G. S. WILSON in which he states that CO_2 is absolutely essential for the initial growth of the bovine *abortus* type of Brucella. This has not been the experience of Bevan and his co-workers in Rhodesia where the local bovine strain is readily isolated in primary culture without regard to the CO_2 or oxygen content of the medium. Bevan suggests that the Southern Rhodesian strain of *Br. abortus* is peculiar to that country. [This point has already been noted by DUNCAN.]

D. H.

CONTERNO (V.). La tripaflavina nella cura della febbre di Malta. [**Trypaflavine in the Treatment of Undulant Fever.**]—*Giorn. d. R. Accad. Med. di Torino.* 1930. Apr.-June. Anno 93. No. 2. pp. 135–137.

Fourteen patients suffering from undulant fever were treated by the method described. They comprised both hospital and private patients ; the diagnosis was confirmed either by blood culture or by agglutination of *Br. melitensis* in a titre of 1 in 800. Nearly all had previously been treated by vaccines, sera, autohaemotherapy or drugs. The author used a 2 per cent. solution of trypaflavine in doses of 10 cc. injected intravenously with two days' interval for 8–10 injections. After 2 or 3 injections the temperature began to fall, in some gradually, in others by crisis [this may have been a natural drop about the 7th day], but the complete course was persisted in. With the fall of temperature the symptoms, subjective and objective, improved, the joint-pains, neuralgias, sweats, enlargement of liver and spleen, together with increase in weight and restoration of the blood to normal. Of the 14 patients, 10 were followed up for several months, and 4 left the town. One of the ten interrupted the course " for fear of vomiting," but nevertheless was free from fever for 20 days. Six were cured straight away, three had a slight return of fever in 1 to 2 weeks, to 37·8°–38·3° C., but these were cured by another 3 or 4 injections. [The remedy clearly merits further trial. See also this *Bulletin*, Vol. 26, p. 446.]

H. H. S.

THURBER (D. S.). **The Results of the Use of Acriflavine Hydrochloride in the Treatment of Undulant Fever.**—*Canadian Med. Assoc. Jl.* 1930. Nov. Vol. 23. No. 5. pp. 665–668. [3 refs.]

Undulant fever due to *Br. abortus* is common in certain districts of Mexico. The author gives an account of 14 cases all diagnosed by positive agglutination tests, seven of which were treated with acriflavine and seven without. The dosage was 0·1 gm., 0·2 gm., and 0·3 gm. at intervals of 3 days. The tablet of acriflavine hydrochloride was crushed up in 20 cc. of warm saline and an intravenous injection of normal saline was given. When this was running well the 20 cc. of acriflavine solution was added to it and slowly injected. In five of the treated cases the fever was arrested within one month after starting the treatment. In the seven untreated cases the fever lasted from 9 months to two years and two of the cases ended fatally.

D. H.

RUDNEW (G. P.) & KRUMBERG (A. J.). Zur Behandlung des Maltafiebers. [**Treatment of Undulant Fever.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1931. Feb. Vol. 35. No. 2. pp. 81–89. With 2 charts in text. [1 ref.] [Therap. Clinic, North Caucasian State Univ., Rostov-on-Don.]

The authors had under observation 3 cases of undulant fever from the North Caucasus, diagnosed on the clinical picture and on a positive agglutination reaction. They discuss methods of treatment and point out that so far there is no specific method, the best results being obtained with vaccine and serum therapy. In the first two cases autohaemotherapy was tried but without any marked result. Injections of "Rivanol," "Osarsol" and carbolic acid were without benefit. Finally, they utilized X-ray therapy, the region of the spleen being irradiated for fifteen minutes with a fixed dose* on 5 or 6 occasions. The authors claim excellent results, the temperature falling to normal and the pains in the joints disappearing. They agree that the number of cases is too small for a definite pronouncement but recommend a more extended trial of the method.

D. H.

LE CHUITON & NÉGRIÉ. Deux cas de mélitococcie traités par les sels d'acridine. [**Two Cases of Undulant Fever treated by Acridine Salts.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1930. Nov. 24. Year 46. 3rd Ser. No. 31. pp. 1633–1635. With 2 text figs.

The first case, which was diagnosed by isolation of *Br. melitensis* from the blood, was treated by injections of trypaflavine in 2 per cent. solution (doses 5–20 cc.). The second case, which was one of laboratory infection, blood culture positive, was treated by injections of gonacrine (0·5 per cent.) in the early stages with excellent results, the temperature falling to normal in the course of two weeks. The authors recommend a trial of these drugs in this disease and also in other bacillaemias.

D. H.

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* Filter.	Tube.	Milliampere.	Duration.	Dose.
4 Al.	10+15	2	15 mins.	1-6.

DUBOIS (Charles) & SOLLIER (Noel). Premiers résultats de la vaccination préventive de l'homme contre la fièvre ondulante. [**First Results of Preventive Vaccination of Man against Undulant Fever.**] —*Ann. Inst. Pasteur.* 1930. Nov. Vol. 45. No. 5. pp. 596–612. [5 refs.]

The authors give two reasons for employing a preventive vaccine for man against undulant fever.—(1) An efficient vaccine for domestic animals has not yet been produced. (2) NICOLLE has successfully employed a preventive vaccine more especially in laboratory personnel. Infection is most common in those whose profession necessitates dealing with infected animals, e.g., veterinary surgeons and farmers, and it is these people who could and should be protected by inoculation.

The vaccine employed consists of various strains, three of melitensis (one of human origen, one caprine, one bovine) and two strains of abortus. It contains four hundred million of each strain in 1 cc., a total of two thousand millions of the five strains. No antiseptic is added but the vaccine is heated at 60° C. for one hour.

Dosage : The first injection is of 0·25 cc. 500 million germs.
Second injection, 0·75 cc. 1,500 million germs.
Third injection, 1 cc. 2,000 million germs.

The full course of injections was given to 111 persons engaged in dealing with infected animals; none of these developed undulant fever in the 3 to 8 months that had elapsed, but of thirty-six others who were not inoculated two contracted the disease.

D. H.

SANFILIPPO (E.). Ueber Immunisierung gegen Mittelmeerfieber. VII. Mitteilung. [**Immunization against Undulant Fever.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1930. Vol. 69. No. 1/2. pp. 157–160. [1 ref.] [Med. Clinic, Univ., Palermo.]

A further contribution to the subject of the immunization of goats against undulant fever [see this *Bulletin*, Vol. 26, pp. 445 & 830]. The method is similar to that already described. Massive doses were employed, the washing of eight agar plates killed by heat constituting the immunizing dose and the test dose being the whole of one living culture. The immunized animals were killed three months after the infecting dose. Careful cultures were made from liver, spleen, lymph glands, bone marrow and mammary glands, but all proved sterile; whereas in the control animals examined two months later bacteria were readily recovered from the liver, spleen and lymph glands, but not from bone marrow or mammary glands.

D. H.

MEDICAL ZOOLOGY.

DOBELL (Clifford). **Researches on the Intestinal Protozoa of Monkeys and Man. IV. An Experimental Study of the *Histolytica*-like Species of *Entamoeba* living naturally in Macaques.**—*Parasitology.* 1931. Jan. Vol. 23. No. 1. pp. 1–72. [2 pages of refs.] [National Inst. for Med. Research, Hampstead, London.]

This is the latest instalment of a series of "Researches on the Intestinal Protozoa of Monkeys and Man," which started in 1928 in *Parasitology* and was continued in 1929 in the same journal; these instalments were noticed in Vol. 26 and Vol. 27 of this *Bulletin*. Concurrent and adjuvant researches on the subject, treating of the cultivation and of the action of ipecacuanha alkaloids upon entozoic amoebae, appeared in *Parasitology* in 1926, 1927, and 1928, and were noticed in Vol. 23, Vol. 24, Vol. 25, and Vol. 26 of this *Bulletin*. Before considering the latest of these researches it may be convenient to take some refreshment from these earlier portions of the crop.

Since all these papers interosculate, and all are based mainly on study of entozoic amoebae *in vitro*, precedence must be given to the paper by Dobell and LAIDLAW "On the Cultivation of *Entamoeba histolytica* and Some Other Entozoic Amoebae," in *Parasitology*, Vol. 18, 1926, p. 283 (this *Bulletin*, Vol. 24, p. 363). Here are found the history of attempts to cultivate *E. histolytica in vitro* and a fitting tribute to BOECK and DREOHLAV whose methods of producing rich cultures of the organism have so vastly enlarged and improved the field of critical study. This now familiar method, and the author's various modifications of it, are discussed. In the B. and D. medium the amoebae do not usually or readily encyst; but in a modification of it, discovered by LAIDLAW and here fully described and debated—the method of adding solid, sterilized, rice-starch to the medium—the amoebae not only multiply enormously but also encyst freely. The encysting phase, however, is not persistent—in subcultures in the rice-starch-media for a variable number of generations cysts become fewer and fewer, and at length the amoebae die without forming cysts at all. These culture cysts are typical cysts like those normally formed in the bowel. Cyst production may be temporarily increased by cultivating the amoebae in a starch-free medium for one or two generations and then inoculating them into media containing rice-starch (though the results at first were uncertain). It was discovered also that cultures of amoebae of *E. histolytica* can be initiated as easily from culture-cysts as from living amoebae, since the cysts effect excystment when incubated in any of the media here described for cultivating free amoebae. Furthermore, it was found that cultures of amoebae can also be initiated from cysts passed in faeces, without any special treatment, although such cysts do not regularly and invariably produce good cultures, even when they have first been washed and cleansed from detrimental organisms and soluble noxa from the faeces. ("Pure" cultures from culture-cysts, it must be borne in mind, are pure only in an amoebic sense; apart from any possible alien contamination there always goes with them an appropriate bacterial *convivium* which has a profound influence on the welfare of the amoebae in culture, and this matter—the importance of the bacterial flora—is much (though not conclusively) debated here.) Another original observation recorded in this paper is loss of infectivity to kittens in *E. histolytica* as an apparent result of cultivation in media containing solid rice-starch.

Next for notice is the paper entitled "Further Observations and Experiments on the Cultivation of *Entamoeba histolytica* from Cysts," in *Parasitology*, Vol. 19, 1927, p. 288 (this *Bulletin*, Vol. 25, p. 227). These

observations are mainly corrective and elaborative. It is here said to be probable that culture from cysts of *E. histolytica* was first done by BOECK and DRBOHLAV in March 1924. It is observed that at ordinary room temperatures free amoebae of *E. histolytica* may survive up to 3 days under culture conditions ; and at 37° C. for at least 5 weeks ; and that cysts of *E. histolytica* may survive at ordinary room temperatures for at least 37 days, though usually they die in a few days. It is also observed here that *histolytica* cysts can hatch and deliver normal amoebae if kept at 37° C. from the moment that they reach maturity, and this in the culture environment in which they were formed. All the experimental detail relating to the resistance of amoebae and cysts and the excystment of the latter is here fully discussed.

Ancillary work of the same minutely critical character, by Dobell, LAIDLAW, *et al.*, on the action of ipecacuanha alkaloids upon *E. histolytica*, is recorded in *Parasitology* (Vol. 18, 1926, p. 206, and Vol. 19, 1927, p. 283) and has been noticed in this *Bulletin* (Vol. 23, p. 660, and Vol. 26, p. 469). The chief conclusions of the first of these two papers are that emetine and cephaeline are specific poisons for *E. histolytica* (and allied simian species), being at least fifty times more poisonous than the other alkaloids of ipecacuanha—isoemetine, psychotrine, methylpsychotrine, demethoxyemetine, or noremetine—under culture conditions ; that strong concentrations of emetine (1 per cent. or more) are needed to kill the parasite instantaneously, though very weak solutions (1 in 50,000 or less) are fatal if allowed to act for a sufficient time ; and finally, that the curative effects of emetine in amoebic dysentery are " probably " due to its direct toxic action on this amoeba. (Other experiments demonstrate *in cultu* the prepotency of emetine above stovarsol (about 10 times) and quinine (about 50 times) and its relative insufficiencies against *E. coli*, *E. gingivalis* and *Endolimax nana*.) Throughout this chemotherapeutic study inspissated horse-serum was the solid constituent and egg-serum or horse-serum diluted with Ringer's fluid the liquid constituent of the culture medium (plus solid rice-starch) and definite quantities (in solution) of the drug to be tested were added to the known volume of the liquid constituent. The chief conclusion from the experiments recorded in the second of the papers on the action of emetine is corrective of the first. The experiments show that a medium which consists of a solid mass of clotted protein in a liquid is not trustworthy for quantitative chemotherapeutic experiments, since the distribution of the chemical between the solid and the liquid varies with the nature of the solid and with time. It is shown that in a wholly liquid medium a solution of emetine 1 in five million was lethal for amoebae of *E. histolytica* (4 strains) *in vitro* within 4 days, provided that the medium did not become too acid.

Having proved that emetine is a specific poison in cultures of the *Entamoeba histolytica* parasite of man (and also of the *histolytica*-like commensal of Macacus monkeys) the author with the assistance of Miss BISHOP proceeded to test its action *in vivo* on the natural amoebic infestations of these monkeys. The experiments are recorded in *Parasitology*, Vol. 21, 1929, p. 446, and have been cited in this *Bulletin* (Vol. 27, p. 389). The conclusion from them is that emetine acts upon these simian amoebic infestations exactly as it does upon the amoebic infections of man and is equally a radical cure for these natural *histolytica*-like infestations. In this paper, which is No. 3 of the series of " Researches on the Intestinal Protozoa of Monkeys and Man," Dobell expresses himself satisfied that *Entamoeba histolytica* of man and the *histolytica*-like commensal of Macacus monkeys are identical—an opinion towards which he had seriously inclined for eleven years.

We come now to No. 1 and No. 2 of these " Researches," which are chronicled in *Parasitology*, Vol. 20, 1928, p. 357, and have been recently summarized briefly in this *Bulletin* (Vol. 26, p. 795). Here the author again acknowledges the debt to BOECK and DRBOHLAV and their discovery of a means of growing Entamoebae in profusion outside the body of a

host, and LAIDLAW's manoeuvre of improving this culture and procuring plentiful encystment *in cultu* by the addition of starch to the medium, is again mentioned. These discoveries, which have made it possible to procure cysts at will in culture, and to keep these "culture-cysts" for many days, and to bring them to bed in fresh cultures and incubate them to beget new generations of amoebae duly submissive to encystment *in cultu*, have made it possible to follow in culture the whole life-history of a specifically pure strain of *Entamoeba histolytica* which is here described in esoteric detail. The strain studied came originally from a *Macacus sinicus* that was under the author's observation for about 3 years. Though the monkey was known to be infested by *E. histolytica* (see below) it had never suffered from dysentery and its only other amoebic infestation was known to be *Endolimax nana*. From this monkey's faeces cysts were taken of which one part (after cleansing processes) was administered at once *per os* to a kitten of six weeks and of certified and confirmed purity, and another part was put to suitable culture and produced amoebae which were proved to be above suspicion as a pure strain of *E. histolytica*. In six days the kitten started an acute attack of typical amoebic dysentery, and from cysts recovered in pure culture from the dysenteric dejecta of this kitten this pure strain—K28c—of *E. histolytica* was started. (The author's experimental proof that this *E. histolytica* from Macacus is identical with the *E. histolytica* of man is offered in the next paper, No. 4.) It may be mentioned that this strain (K28c) was isolated and established in culture in 1926 and was still maintained in serial subcultivation when the author's latest paper was published in January 1931. When cysts are required the author inoculates them into the starch-free B. and D. medium, in which by incubation he gets excellent cultures of the amoebae. These amoebae are inoculated into B. and D. medium to which a little solid rice-starch has been added. At the beginning of incubation (at 37° C.) in this starch-medium abundant active amoebae along with pre-cystic forms and immature cysts are to be found; later, up to 48 hours, an abundance of ripe cysts; still later, up to a week or so, amoebae in decreasing number, but few or no cysts, as already mentioned. By tapping the incubator at the right times trophozoite-amoebae, ripe cysts, or any other intermediate forms can be obtained for study. But to have success in this culture process the medium must be sterile before inoculation, the added rice-starch also must be sterile, the so-very-fastidious bacterial convivium [see above] must not be altered by accidental introduction of alien gate-crusher microbes, and the temperature in the incubator must be maintained continuously at 36·5–38° C.

Various other media are described as quite suitable provided rice-starch is added. The life-history of *E. histolytica* in cultures is described in infinite detail (25 pages, exclusive of formal discussion and summary) and to a full and most harmonious accompaniment of text-figures and artistic plates; the author takes no step without qualifying long-drawn-out strains of explanation. He describes the following procession: the trophic amoebae; the smaller precystic amoebae with more or less excentric caryosome; the encystment and the cysts; the excystment, and the metacystic amoebae. Here a long pause occurs in the story, for although each quadrinucleate metacystic amoeba that hatches from each quadrinucleate cyst develops into eight young trophic amoebae, it does so in a complicated series of nuclear divisions followed by cytoplasmic fissions. In the excystment a single quadrinucleate amoeba escapes from each cyst through a minute perforation in the wall. This excysted quadrinucleate "metacystic" amoeba feeds voraciously, and in two or three hours has grown large (16–20 μ). Then one nucleus divides, the other nuclei remaining at rest for a while. Then a strangely complicated series of successive nuclear divisions succeeded by cytoplasm fissions follows (through thirteen pages of description), each nuclear division being followed by a fission of the cytoplasm and a variable period of growth, until from the original quadrinucleate amoeba that came out of the cyst a new generation of

eight uninucleate amoebules has come into being. The amoebules are young trophic amoebae, not gametes or conjugants: "no sexual phenomena of any sort have been observed during the metacystic stages . . . the life-history of *E. histolytica*, as visible *in vitro*, is thus wholly asexual." Although this account of the life-history *in cultu* of *E. histolytica* is based on a stock derived from a Macacus monkey, the author is careful to explain that a similar life-history has been observed by him in other cultivated strains of *E. histolytica*, including a strain isolated straight from man and a human strain experimentally implanted in a *Macacus sinicus* and recovered therefrom in pure culture. The account concludes with a discussion of some points in the recorded observations of other writers on the life-history of *E. histolytica*. BOECK and DRBOHLAV have already received high appreciation as ποιμένα λαῶν, and are again noticed as (probably) having also been the first to obtain encystment *in vitro* and to obtain a culture by hatching cysts from stools; CHATTON (1917) obtained excystment *in vivo* and observed that the cysts hatched as active and voracious quadrinucleate amoebae whose nuclei became agglomerated "en tetraèdre"—corresponding, in short, with the author's "metacystic" amoebae; and YORKE and ADAMS (1926) made cultures by incubating cysts (from stools) in B. and D. medium, and they also observed excysted quadrinuclear amoebae; but their account of the subsequent behaviour of these amoebae perplexes the author. Seven other names are mentioned, of writers whose observations, where not accurate, are not submissive to interpretation by the author.

We now come to the memoir, No. 4. "An Experimental Study on the *Histolytica*-like species of Entamoeba Living Naturally in Macaques," that is the particular object of our regard. It contains a full account of the experimental evidence—short of the conclusive extreme that might necessitate a human sacrifice—justifying the author's opinion, first formed (on facts then more open to contention) eleven years ago, that the *Entamoeba histolytica*-like organism living as a natural commensal in the gut of monkeys of the genus Macacus and the *Entamoeba histolytica* parasite that usually causes amoebic dysentery in man are identical. In the memoir, for convenience, the one is styled *Entamoeba histolytica macacorum* and the other *Entamoeba histolytica hominis*.

At the outset the author explains, in order that his methods and results may not be assailed by shallow and ignorant criticism, that the animals employed in his experiments—5 *Macacus rhesus*, 4 *Macacus sinicus*, 1 *Macacus nemestrinus*, and 40 kittens mostly six to ten weeks old—were no unconsidered and ill-conditioned waifs and strays but were animals of unimpeachable credentials. He knew his monkeys well. They all were healthy and vigorous. He had pet names for them and treated them as friends; his own words are "I have devoted far more attention to their diet, health, happiness and general well-being than I have to my own." They were a tamed, trained, well-behaved family under the author's daily personal observation and were never entrusted to assistants for experiments. The 40 kittens, with few exceptions, were born in the Institute. They were bred and cared for by the author himself. They had pet names, and although they were housed separately they were often allowed out for play together. They were fed on pasteurized milk and boiled fish. They were fondled and kept amused when cysts and amoebae had to be taken and went to the operation purring. When one tries to picture the happy, healthy and interesting environment of these animals—and of the similar possibility of subsequent post-mortem proceedings—one cannot but think of the foxes hunted by the famous Mr. Jorrocks

which were said by him to enjoy the pleasures of the chase equally with the huntsmen, the horses and the hounds. We use this simile in no spirit of levity, but in a just appreciation of the author's humane resolve to keep his animals not only free from any misleading and mystifying taint but also free from pain and ennui.

The Entamoebae of the present long series of researches were derived from ten Macacus monkeys and two human beings. "All the strains were morphologically typical, with cysts measuring 11–14 μ diameter." Most of them have been cultivated at times in cultures that were free from all other protozoa but had an unknown though stable accompaniment of the needful bacteria. The methods of cultivation were the various modifications of the B. and D. medium devised by LAIDLAW and the author. Great stress is again put upon the necessity of a certain bacterial convivium in a culture designed to produce encystment of amoebae. "If these bacteria are absent the amoebae never encyst, no matter how much starch they may eat, or how much the other cultural factors may be varied." In the case of the strain K 28c (mentioned in previous papers) the necessary bacteria are present surely and constantly. A "discontinuous" method of protracted cultivation of many pure strains of *E. histolytica* has been devised by the author. He cultivates the active amoebae (in the usual ways) for about a week and then makes them encyst (in the starch way described). The cysts are then stored in the ice-chest at a temperature of about 8° to 12° C. for about a month. At the end of the month the cysts are hatched again, and the process is repeated as long as necessary.

At last we come to the experiments demonstrating (1) the significantly varying results of inoculating kittens with different strains of *Entamoeba histolytica macacorum*; (2) the results of inoculating different species of Macacus monkeys with *Entamoeba histolytica macacorum*, and (3) with *Entamoeba histolytica hominis*; and (4) to supplementary experiments on the infectivity of *Entamoeba histolytica* for kittens, and on the ingestion of human red blood corpuscles by *Entamoeba histolytica in vitro*—and then to the author's own general conclusions.

1. *Experimental Infection of kittens with* E. histolytica macacorum :—

In the early experiments living amoebae (*per anum*) or cysts (*per os*) in fresh faeces of a monkey were introduced into seven kittens. All these experiments gave entirely negative results—no amoebae in any, and no amoebic lesions found in the four post-mortem examinations made. These early experiments were made in days before the author had learnt how to cultivate *E. histolytica.*

Afterwards the author attempted to infect kittens with *E. h. macacorum* by means of culture-amoebae (*per anum*) or culture-cysts (*per os*); and pure and carefully tested strains from 4 monkeys were administered to 8 kittens. The results in 7 cases were negative; but in one case the kitten (K15), which had received culture amoebae derived from the normal faeces of a particular *Macacus sinicus* named "Bonar," on the following day passed blood and mucus, cultures from which showed abundant amoebae.

Further experiments were therefore made with this "Bonar" K15 strain and its derivatives. Six kittens inoculated either direct from

kitten 15 or from other kittens infected through the intermediation of K15 all became infected, passing mucus, blood, and many active amoebae, and showing *post-mortem* lesions, of the large gut alone, quite like those of amoebic dysentery in man ; they had no serious symptoms of dysentery however—nothing like the fulminating dysentery so often seen in kittens infected by human strains of *E. histolytica* ; the incubation period in these kittens, which were inoculated *per anum*, varied from 1 to 9 days. Another kitten—an animal of " extraordinary liveliness and vigour "—of a " playfulness almost pathological "—was entirely refractory to this same strain, and after resisting three powerful attempts at infection was finally discharged—a healthy half-grown cat —as " uninfected and uninfectible." In some other experiments with this strain two kittens were fed with cysts in the concentrated faeces of " Bonar " himself ; six days afterwards both contracted a " mild nontransmissible dysentery " and after recovery grew to normal healthy cats. In some other experiments culture-cysts of this usually infective strain failed to infect kittens ; whether or not they had lost their infectivity in the course of continued cultivation the author cannot say ; but he recalls the earlier discovery that by continued cultivation a strain of *E. histolytica hominis* lost its infectivity for kittens. All these experiments (16 pages) demonstrating and clarifying the history and behaviour of the *E. histolytica* of Macacus monkeys in kittens, are described in a detail that may be fairly described as Olympian, so resolute is the author to allow no footing to the shallow or inattentive critic.

2. *Experimental infection of Macacus monkeys with* E. histolytica macacorum :—

The next step is to inquire whether or not all the strains of *E. histolytica macacorum* isolated from the three species of Macacus monkeys at the author's service are as identical in their properties as they are in their morphology. The experiments to this end fill 9 pages, and their course and results are thus summarized by the author himself : " Attempts to transmit strains of *E. histolytica macacorum* from one species of *Macacus* to another have been uniformly successful. All the strains used were isolated in pure culture, and carefully tested and studied before trial : and all the macaques employed were previously freed from infection with *E. histolytica* by treatment with emetine, and were proved to be ' clean ' by prolonged daily examination of their faeces—both microscopically and culturally. With such material and precautions, it has been found possible to transmit a strain of *E. histolytica* from one *Macacus sinicus* to another *M. sinicus :* a strain from *M. rhesus* to *M. sinicus :* and a strain from *M. nemestrinus* to *M. rhesus* and thence to *M. sinicus*. These experiments have shown that strains of *E. histolytica macacorum* may be cultivated in various media for any period up to about a year and a half without losing their infectivity for macaques. They have also shown that normal culture-cysts are just as infective as cysts formed naturally in the intestine. The strains of *E. histolytica* employed were all derived from healthy non-dysenteric monkeys, and produced no dysentery on introduction into their new hosts. All macaques became demonstrably infected within 4 days at most after ingestion of culture-cysts of *E. histolytica macacorum :* and in every case the induced infection persisted for the duration of the experiment (maximum period 15½ months)."

3. *Experimental infection of Macacus monkeys with* E. histolytica hominis :—

In these experiments a pure strain, or its derivatives, originally derived from a patient suffering from acute amoebic dysentery was used. The strain was isolated by DRBOHLAV in 1924, and a subculture from it has been maintained by the author ever since, cultivated for the most part in horse-serum and Ringer-eggwhite medium with rice-starch. The macaques employed had been cleansed of natural or of other previous infections by emetine treatment. The following is the author's summary of the events: "A strain of *E. histolytica*, derived from a man suffering from acute amoebic dysentery, has been cultivated *in vitro* continuously for 5½ years. After cultivation for 2½ years it was successfully transmitted to *M. sinicus*. On recovery from the experimentally infected monkey, its derivative was further cultivated for 2 years, and then transmitted to *M. rhesus*. The original strain itself has also been directly transmitted to both *M. sinicus* and *M. rhesus* after continuous cultivation for 5 years. . . . . In all the monkeys (only 3 in number) infected experimentally, no dysenteric symptoms or lesions were observable at any time." The author adds that these experimental infections persisted to the end of observation (maximum 16 months).

Supplementary experiments on the infectivity of E. histolytica *for kittens ; and on the ingestion of human red corpuscles by* E. histolytica :—

In 1926 DOBELL and LAIDLAW discovered that a strain of *E. histolytica hominis* after it had been cultivated *in vitro* for about 2 months lost its infectivity for kittens. This fact, which some people have been unwilling to believe, was confirmed in the present experiments. In another experiment it was found that a strain of *E. h. hominis* isolated from a patient not suffering from dysentery infected a kitten quite as readily (and as savagely) as another strain isolated from a patient with acute dysentery. In another series of experiments here described and tabulated it was found that when strains of *E. h. hominis* and *E. h. macacorum* which had lost their infectivity for kittens (as a result of cultivation *in vitro*) were passed through *M. sinicus* or *M. rhesus*, their infectivity was not regained.

Great and manifold are the experiments and observations here summarized on the ability or inability of *E. histolytica* to ingest red blood corpuscles, *in vitro*. In the author's experience *E. h. macacorum* never does, and *E. h. hominis* usually does, although in certain circumstances strains that possess the power may lose it, and *vice versa*.

In the final summing-up the author pronounces in favour of the verdict that the *histolytica*-like amoeba (here called *E. histolytica macacorum*) living naturally in the monkeys *of the genus Macacus* is identical with *Entamoeba histolytica* of man. In morphology and life-history the two are identical and they develope in the same way *in vitro* under the same conditions, they also are equally sensitive to minute quantities of emetine. *E. h. hominis* is known as a destructive parasite of man and is usually able to produce a rapidly fatal dysentery in kittens ; it usually ingests red blood corpuscles ; but in cultivation *in vitro* it ingests bacteria and starch-grains, etc., just like *E. h. macacorum*, and may lose its power of infecting kittens and ultimately may also lose its ability to ingest human red corpuscles. *E. h. macacorum* is usually known as a harmless commensal feeding on bacteria and

faecal debris and unable to ingest red blood corpuscles ; frequently it is quite unable to infect kittens or may cause in them a mild dysentery ending spontaneously and with possible complete recovery ; moreover it has been said to be able to ingest human red corpuscles *in vitro*—although this is contrary to the author's experience with amoebae derived from perfectly healthy monkeys. The differences between *E. h. hominis* and *E. h. macacorum* are thus seen to be inconstant and variable—and so not of specific import.

The following are the author's own general conclusions :—

"The main conclusion to be drawn from all the experiments here described is that the *histolytica*-like *Entamoeba* living naturally in *Macacus rhesus*, *M. sinicus*, and *M. nemestrinus* (and probably in other species of the genus) is identical with *E. histolytica* of Man. All the evidence hitherto obtained supports this interpretation, and no sound arguments can be urged against it.

"Other conclusions which can be drawn from all my researches in the present connexion—including those published previously—are of more general interest. It has been shown that monkeys of the genus *Macacus* (=*Silenus*) are natural hosts of *E. histolytica*, and can therefore be used instead of human beings for experimental study of this parasite. It has further been shown that it is now practicable (1) to isolate any desired strain of *E. histolytica* from a man or a macaque, and maintain it *in vitro* for any required period ; (2) to obtain at will any stage in its life-history *in vitro* at any given moment : (3) to introduce this strain into a natural host (*Macacus*), study its behaviour therein, and recover it in culture whenever necessary : and (4) to eradicate it from this host permanently, if desired, by chemotherapeutic methods. Host and parasite can thus be kept separate, can be united, and can again be separated *ad libitum* ; and any desired experiments can therefore be performed with either severally or with both combined. I believe that we possess, at present, such complete experimental control over no other animal endoparasite."

A. Alcock.

ERRATUM.

Vol. 28, No. 7, p. 531, footnote. Translation from Horace. *For* 'Whate'er the preconceptions are' *read* 'Whate'er thy preconceptions are.'

YELLOW FEVER.

LEAGUE OF NATIONS MONTHLY EPIDEMIOLOGICAL REPORT. 1931. Apr. 15. Vol. 10. No. 4. pp. 139–147. With 2 maps. [2 refs.] —**Yellow Fever from 1927 to the Beginning of 1931.** [In parallel French & English.]

A general review of the incidence of yellow fever during the past four years. In Africa since the height of its prevalence in 1927, when cases occurred in the various countries from Senegal in the north to Belgian Congo in the south, and showed great virulence (e.g., 117 cases with 111 deaths in Senegal, 107 cases with 40 deaths in the Gold Coast), the number of cases has gradually diminished, until in 1931 only four suspected cases and one death have been recorded, all in the Mamfe province, Cameroons.

In South America, on the other hand, there has been a marked increase in the prevalence of the disease during the past 4 years. In addition to the Rio epidemics of 1928 and 1929, cases have been recorded from various other parts of Brazil and from Colombia. During the present year (1931) 34 cases have been recorded occurring in more than 13 different and widely scattered localities ranging from the state of Rio in the south to Ceara in the north, and inland to Palma. The lack of connexion between these cases strongly suggests that the disease may persist for a long time in the interior of the country without being revealed by epidemic outbreaks. Moreover, the fact that it attacks more particularly foreigners supports the view that the infection persists under a more or less latent form in the native population.

Attention is drawn to the danger of commercial air services, the necessity of avoiding infected zones in the establishment of routes, or of edicting special measures for such zones. Finally the interdiction by law to import or keep yellow fever virus for any purpose whatever in Eastern countries open to contamination has been adopted by the Philippines, British India, British Malaya and Australia. [The statement to the effect that the passage of yellow fever virus through *Macacus rhesus* markedly increases its virulence is entirely without foundation.]

E. Hindle.

SMITH (H. F.). **Résumé of Report on Sanitation and Yellow Fever Control in Liberia.**—*Public Health Rep.* 1931. June 5. Vol. 46. No. 23. pp. 1353–1359. With 8 figs. on 4 plates.

The author, an officer of the United States Public Health Service, was detailed to act as medical adviser to the President of Liberia, and his report is a striking condemnation of the Liberian Government so far as sanitary measures are concerned.

The officials were not in sympathy with yellow fever control measures, and many of them expressed disbelief in the existence of the disease. On June 3, 1930, a case of imported yellow fever occurred in Monrovia, diagnosed by one of the two European physicians, but as soon as the diagnosis was made the family of the patient discontinued his services, and employed a native doctor. The patient died three days later and the cause of death was given as "strangulated hernia."

The author was not allowed to examine the mortality records, but by appealing to the President was able to see the city burial permits from May 1 to September 1, after which permission was again refused.

The conditions of Monrovia throughout the year are ideal for the propagation of Aedes and 96 per cent. of the premises inspected in the city were found to be breeding mosquitoes. From the information available the author considers that yellow fever has existed in Monrovia for a long period of time, though it is impossible to estimate the number of cases owing to the absence of records. However, 10 weeks' prophylactic measures directed solely toward correcting conditions favouring the spread of yellow fever resulted in a diminution of the number of deaths in May by more than 75 per cent. as compared with any previous May. It is not improbable that the marked increase in the number of deaths which had occurred previously at this time of the year was actually due to yellow fever, and the success of the author's short sanitary campaign shows the value of such work. It is to be regretted that the measures recommended by the author were not adopted by the Liberian Government. E. H.

RAMSEY (George H.). **Yellow Fever in Senegal with Special Reference to the 1926 and 1927 Epidemics.**—*Amer. Jl. Hyg.* 1931. Jan. Vol. 13. No. 1. pp. 129–163. With 3 folding maps. [37 refs.]

It was found that even in the coastal towns of Senegal the temperature was high enough to permit the survival of adult *Aedes aegypti*, and therefore the disease could exist throughout the year. Owing to the scattered population the colony is considered to be a potentially epidemic rather than an endemic yellow fever area. Moreover, the record of epidemics at irregular intervals since 1778 supports this view. Although during the 1926 and 1927 epidemics all the reported cases were among white persons, the number was insufficient to explain its wide geographical distribution, and the author is of the opinion that the natives must have been attacked in numbers greatly exceeding its incidence among the white population. It is concluded that the natives must have constituted a vast but hidden reservoir of infection.

[The statement on p. 129 " The man sick with yellow fever remains infective only for a very few days, probably not more than three or four " is not supported by experimental work on monkeys, which shows that the blood is infective to mosquitoes during the incubation period before the onset of fever (see HUDSON and PHILIP, this *Bulletin*, Vol. 27, p. 489).] E. H.

FRAGA (Clementino) et al. A febre amarella no Brasil. Notas e documentos de uma grande campanha sanitaria. [**Yellow Fever in Brazil. Notes on an Extensive Sanitary Campaign.**]—*Brasil-Medico.* 1930. Sept. 27 & Oct. 4. Vol. 44. Nos. 39 & 40. pp. 1081–1086; 1113–1120.

After a few remarks on previous epidemics in 1685, 1850, and 1908, the author describes more minutely that of 1928–29. The first patient was a soldier dying on the 16th day of a disease diagnosed as influenza; three days later another soldier died and the nature of the infection was determined at necropsy. These and two others occurred during the last week of May 1928. By the end of the year there had been

125 cases, 73 of them fatal. Of these 52 were notified in June, 40 in July. Very few occurred in the last 3 months of that year, but in January 1929 the numbers increased to 29, in February 54, in March 241, in April 190, a fall to 87 in May, and after that 9, 1, 0 and 2 only in successive months and the last two contracted the disease in Nichtheroy. This gives a total for 1929 of 613 of whom 363 died, and for the whole epidemic 738 with 436 deaths (59·07 per cent.). Tables are presented showing the distribution, so far as it could be ascertained, as regards age, sex, race, and length of residence. 115 were under 15 years, and of these 78 died (67 per cent.); 538 were above this age and 350 died (65 per cent.); the ages of the remaining 85 were not known. As regards sex, 561 were males of whom 338 died (60 per cent.) and 177 were females, and of these 98 died (55 per cent.). Length of residence could be ascertained in 450 only, and of these 360 had been in the locality less than 3 years.

Measures undertaken for combating the outbreak are grouped under two main headings, those dealing with the mosquito, and those with man. Under the former are included antilarval measures as applicable to estates, streams, bushy ground, fallow land and ships. The adult insect was attacked by catching in houses and by disinfection by means of Clayton apparatus, and by sprays, petrolization and so forth. The area to be dealt with was divided into districts, inspectors appointed for each with assistants to treat the conditions found. Under the latter—treatment of patients, contacts and suspects—the measures consisted of isolation of patients, close observation of others, protection by mechanical means as by use of mosquito nets, and by immunization. A few words are added on the application of these various measures to different districts, Rio de Janeiro, S. Paulo, Minas and others.

H. H. S.

CARNEIRO (Homero). Considerações sobre o surto de febre amarella em Nova Iguassú (1929–1930). [**The Outbreak of Yellow Fever in Nova Iguassú, 1929–30.**]—*Folha Med.* 1931. Apr. 5. Vol. 12. No. 10. pp. 109–112. With 1 chart in text.

Nova Iguassú, the chief town of Iguassú, an hour's distance by rail from the Federal District of Rio de Janeiro, was the seat of an outbreak of yellow fever between March 1929 and September 1930. The author describes the general condition of the locality, the large number of pools, insufficient drainage, etc., favourable to the breeding of mosquitoes. As soon as suspicions arose as to the nature of the disease a force of inspectors, nurses and visitors was got together, the area involved being divided into five zones. A small hospital of 10 beds was erected. The inspectors made house to house visits, notified any suspicious cases, took their temperatures and sent off specimens of urine for examination. Out of a population of 6,000, thirty-two were removed and the diagnosis was confirmed in 26. Fourteen of these were among 5,400 natives, and 12 among 600 foreigners; 23 were white and 3 coloured persons; 19 male, 7 female. Two were between 1 and 10 years, eight between 11 and 20, ten in the third decade, two in the fourth, three in the fifth, and one was over 50 years. There were 18 deaths. The sanitary squads destroyed all the mosquitoes they could

find, by killing and by disinfection of dwellings, and took the usual methods of dealing with pools and other breeding sites.

H. H. S.

WARD (Espine). **A Case of Yellow Fever, with Recovery.**—*West African Med. Jl.* Lagos. 1931. Jan. Vol. 4. No. 3. pp. 67–68.

The record of a non-fatal case of typical yellow fever in a British woman, occurring during July 1930 near Cape Coast Castle, Gold Coast. The last recognized case in this locality occurred three years previously. The diagnosis was confirmed by inoculation into monkeys.

E. H.

PETTIT (Auguste). Rapport sur la valeur immunisante des vaccins employés contre la fièvre jaune et la valeur thérapeutique du sérum antiamaril. [**A Report on the Protective Value of Yellow Fever Vaccines, and the Therapeutic Value of Immune Serum.**]—*Bull. Acad. Méd.* 1931. Mar. 31. Year 95. 3rd Ser. Vol. 105. No. 13. pp. 522–526.

The French Academy of Medicine, in order to answer questions from the Government on the yellow fever problem, appointed a committee composed of ROUX, BERNARD, RENAULT, Pettit and MARCHOUX, and the present report comprises their conclusions.

HINDLE's results are reproduced in which out of 50 rhesus monkeys receiving one dose of his vaccine followed at various intervals by active virus, 39 were protected and 11 died of yellow fever. Pettit and STEFANOPOULO obtained better results by using two injections; for of 11 monkeys protected in this manner and inoculated with a large dose of very active virus 10, 15 and 20 days respectively after the last injection, all survived. In addition monkeys were protected by inoculating a mixture of virus and horse or monkey immune serum.

A report from CHAGAS as to the results of vaccination in Rio, states that at first in some localities it was successful; later, failures were observed, but it is thought that the dose (2 cc.) was hardly sufficient. The vaccine was tested in monkeys some of which were completely protected but in other cases this immunity broke down. Summarizing the various reports the committee state that "the principles which have guided HINDLE and his followers seem reasonable, but the practical conditions of application should be the subject of further studies."

Attention is then directed to the observations of Pettit, STEFANOPOULO and FRASEY [see this *Bulletin*, Vol. 26, p. 307] on the protective value of horse serum immunized against yellow fever, and its possible use in the treatment of cases of the disease.

Finally it is concluded that at the present time no method of vaccination, serum therapy or of chemotherapy has been sufficiently studied to put into practice. Convalescent serum is of protective value, if required for human therapy. That of the horse and monkey is prophylactic and curative in the monkey but its effects in man are uncertain. In the case of vaccination, it is necessary to be sure that the vaccine is harmless and to have precise details of its preparation and efficacy. Chemotherapy has uot yet furnished any practical results.

E. H.

ARAGÃO (Henrique de Beaurepaire). Sôro-virus vaccinação na febre amarella. [**Protection against Yellow Fever by the Combined Use of Serum and Virus.**]—*Brasil-Medico.* 1931. Jan. 17. Vol. 45. No. 3. pp. 49–51.

Much information is compressed into this short paper. The author first speaks of the three modes of protection employed: 1. Passive immunization by injection of the serum of a recovered human patient or of an immunized monkey. This he has found very serviceable in doses of 1–4 cc. for those working on yellow fever in laboratories or in places where they are liable to be bitten by mosquitoes. Over 200 have been thus inoculated at the Oswaldo Cruz Institute, and none has been attacked by the disease. 2. Active immunization by emulsions of organs of infected monkeys (the original method of HINDLE); for man the author gives 2 cc., and states that during the 1928–29 epidemic some 25,000 were vaccinated [no mention is made of any cases arising among these]. 3. Combined serum virus inoculation; for man 4 cc. (for *rhesus* 1–2 cc.) of serum of a recovered patient are injected, and 24 hours later 0·1 cc. of virulent blood or its equivalent in dried blood [the author states in a footnote that 1 cc. of blood is reduced, when dried, to 0·165 gm.; hence 0·1 cc. = 0·016 gm.]. Twelve days later injection of 0·1 cc. of virus consolidates the immunity. Details of 5 *M. rhesus* so treated are given demonstrating resistance to subsequent inoculation with virulent blood. The dried blood if kept at low temperature was found to retain its virulence unimpaired for a year.

Further experiments were undertaken to show that a smaller quantity of serum (0·5 cc.) was also effectual when given intravenously, but that by the ordinary subcutaneous route less than 1 cc. was ineffectual for rhesus and 4–5 cc. should be the dose for man. Attempts to obtain serum by inoculation of horses were not satisfactory, the product having but low protecting power. Lastly, in place of the serum and virus being injected on different days, they were given in different parts of the body on the same day. Though the animals did not succumb to subsequent inoculation of virus they reacted with fever more or less prolonged.

H. H. S.

DAVIS (Nelson C.). Uso experimental de uma vaccina cloroformada contra a febre amarella. [**Experiments with a Chloroformed Vaccine in the Prophylaxis of Yellow Fever.**]—*Brasil-Medico.* 1931. Mar. 21. Vol. 45. No. 12. pp. 268–270. [6 refs.]

The use of a chloroform vaccine prepared from yellow fever organs, liver and spleen, is not new, and reference is made to the work of MONTEIRO (see this *Bulletin*, Vol. 27, pp. 493 and 877), after which details are given of the preparation of the vaccine employed in the experiments related in the sequel. It is a modification of Kelser's original method.

(a) The liver of an animal (*M. rhesus*) just dead of yellow fever is removed, cut small, washed in physiological saline (to remove excess of blood) and weighed; (b) the fragments are triturated with sand and saline is added gradually, 1 cc. to each gram of tissue; (c) it is then filtered through at least four layers of gauze (to hold back any particles that will not pass a hypodermic needle No. 20) and placed in flasks to hold 30 cc. (d) Chloroform to 1 per cent. is added and the product kept on ice with frequent shaking for several days.

Five series of experiments were performed. The details of each are given and the principles of them consisted in inoculating *M. rhesus*, usually six (in two experiments three), with one or more doses of vaccine at various intervals after the date of preparation, from 5 up to 83 days, noting any disturbance produced, and after a further interval testing immunity by injection of yellow fever virus, in the usual way. It is worthy of note that in one series of 3 animals in which a mixture of two vaccines, each 28 days old, was injected, two died of typical yellow fever 10 and 11 days later. MONTEIRO reported the death of a monkey inoculated with a formol (2 per cent.) phenol (5 per cent.) vaccine prepared 27 days before, but the incubation period was prolonged 23 days (*Archivos Hygiene.* Rio de Janeiro, iii.2.141).

The tests were too few to justify general conclusions, but it may be stated that vaccine prepared as above retained its virulence for 4 weeks at least when kept at a temperature of 10° C. ; that 1 cc. of the vaccine, prepared less than 3 months before, did not protect against a dose of virus administered 40 days after the vaccine, and finally, it is concluded that, if there is a period in which it is avirulent and at the same time effective in conferring good immunity, such period is of short duration.

H. H. S.

SCHÜFFNER (W.), DINGER (J. E.) & SNIJDERS (E. P.). Immuniseeringsmogelijkheden bij gele koorts. [**A Possible Method of obtaining Immunity against Yellow Fever.**]—Reprinted from the *Versl. d. k. Akad. v. Wetensch. te Amsterdam, Afd. Natuurk.* 1930. Vol. 39. No. 9. 2 pp.

Yellow fever does not occur in the Dutch East Indies and the suggestion arose that this absence might be due to the general prevalence of dengue. There were obvious objections to yellow fever experiments being undertaken in Sumatra where *Aedes aegypti* abounds and the Government asked for tests to be carried out in Holland.

Snijders accordingly sent from Medan to Amsterdam mosquitoes (*Aedes aegypti* and *Aedes albopictus*) which had fed on dengue fever patients, and volunteers were infected in Amsterdam by these mosquitoes. One of the authors (J. E. D.) was thus bitten and he had a year previously suffered from a mild attack of yellow fever, and a month prior to this experiment his blood was found to protect *M. rhesus* against yellow fever virus. He showed symptoms of dengue, thus proving that yellow fever did not immunize against dengue.

One experiment with 3 rhesus to test the opposite of this was not conclusive ; the control and one of the two injected with the blood of dengue patients [? via mosquitoes] died after injection with yellow fever virus [interval between inoculation of the two viruses not stated]. The other when killed showed none of the signs of yellow fever and its blood did not cause the disease when injected into another rhesus.

Twenty rhesus were procured for further tests. These were infected either by the bites of mosquitoes or by injection of the blood of one of the dengue-infected volunteers. Some died of intercurrent disease, others of an undiagnosed condition ; hence the possibility of dengue being fatal for monkeys must not be overlooked. Eight remained and were inoculated with yellow fever virus. Two died of yellow fever (as did the controls), the others remained healthy, and it is inferred

therefore that "soon after passing through an attack of dengue, rhesus exhibits a relatively strong immunity to yellow fever."

It was found that *Aed. albopictus*, which is common in D.E.I., can also take up and retain the yellow fever virus, but transference of infection by it is much less constant. Of 10 monkeys bitten by them only one died of yellow fever. Eight of these were re-inoculated with virulent yellow fever virus, 5 died (one of intercurrent disease) and 3 survived. [This also is not conclusive without further details, the first (mosquito) inoculation may have caused a mild attack or perhaps an *infection inapparente*.]

A further point of interest was noted, namely that lowering of temperature seemed to affect the infectivity of the virus in *Aedes aegypti*. The mosquitoes having been kept for some days in a room at 16° C. were then allowed to bite monkeys. None of the latter died but all proved to be immune when re-inoculated with infective virus. This behaviour of "cooled mosquitoes" needs further investigation, and, as the authors state, the above results, relative to dengue and yellow fever, obtained in monkeys may not necessarily prove valid for man, but if confirmed they may open up another method of procuring immunity to yellow fever.

H. H. S.

DAVIS (Gordon Ernest). **Complement Fixation in Yellow Fever in Monkey and in Man.**—*Amer. Jl. Hyg.* 1931. Jan. Vol. 13. No. 1. pp. 79–128. With 5 graphs. [40 refs.] [Yellow Fever Labs., Internat. Health Division, Rockefeller Foundation, Lagos, Nigeria, & School of Hyg. & Public Health, Johns Hopkins Univ., Baltimore.]

The author gives a detailed account of his experiments on the elaboration of a complement fixation test in yellow fever and the results of its application in a large number of monkeys and human beings. The most satisfactory antigen was found to be plasma or serum virus, obtained by collecting the blood of infected monkeys on the first or second day of fever. Both virus and complement were inactivated simultaneously by heating at 55° C. for 15 minutes. When titrated against convalescent monkey serum diluted 1 : 10, the serum virus antigen fixed complement in dilutions 1 : 50 to 1 : 1,000. The majority of the tests were made with the antigen diluted 1 : 100. The removal of native complement was effected by heating at 55° C. for 15 minutes, not longer. Serum and antigen were allowed to remain in contact for 10 to 25 minutes before adding complement, and the mixture then kept at 6° to 8° C. for 15 to 18 hours. The anti-sheep rabbit serum and sheep red cells were than added separately and the tubes incubated at 37° C. for one hour.

The author tested the sera of more than 400 monkeys and 27 persons who had survived illnesses diagnosed as yellow fever and his conclusions are supported by protocols giving the results of the experiments. Unfortunately this complement fixation test, although giving such very definite results with monkeys, entirely failed when applied to human sera, possibly owing to the complexity of the antigen. Consequently, the present method can be of no assistance in determining endemic areas of yellow fever. Sera from monkeys that had recovered from an undoubted attack of yellow fever invariably fixed complement in the presence of serum virus antigens, whilst sera from

normal monkeys never fixed complement. The sera of monkeys that had survived successive doses of active yellow fever virus but without showing any thermal reaction also fixed complement, to the same degree as ordinary recovered monkeys. Sera from monkeys that had been vaccinated in various ways failed to fix complement ; but when the vaccine was followed by a dose of active virus, some of the sera fixed complement whilst others did not. Sera from passively immunized monkeys also failed to fix complement after the inoculation of active virus unless there was a thermal reaction indicating incomplete protection. The antibody content of sera from convalescent monkeys was found in many cases to remain fairly constant for several months. In other cases it diminished after some weeks but its strength could be restored by the inoculation of either fresh or inactivated virus. Evidence of a true antigen-antibody relationship was afforded by the successful passive sensitization of both guineapigs and rabbits. Moreover the rapid rise in the titre of the serum of a protected monkey following the inoculation of macerated infected mosquitoes is additional evidence of biological specificity.

[The original paper should be consulted by those interested in further details of the author's work on this subject.]

E. H.

FROBISHER (Martin), Jr. **Results of Complement Fixation Tests with Yellow Fever Antigens.**—*Jl. Preventive Med.* 1931. Jan. Vol. 5. No. 1. pp. 65–78. [20 refs.] [Yellow Fever Lab., Rockefeller Foundation, Bahia, Brazil.]

A continuation of the experiments on complement fixation previously recorded by the author [see this *Bulletin*, Vol. 26, p. 1004]. The test has given about 87 per cent. correct reactions with serum from 159 human beings and 175 monkeys, but the accuracy of the test is probably about 90 per cent. as some of these cases may have been incorrectly diagnosed. With yellow fever antigens the test seems to be highly specific and there is no good evidence of undue interference by other diseases, although it is possible that some of them, especially syphilis, may occasionally cause falsely positive reactions.

The concentration of complement fixing bodies reaches its maximum in the blood of monkeys after 30 to 40 days and remains in the circulation for a few months to more than a year. After disappearance of these complement fixing bodies a second injection of virus will restore their strength in the absence of fever, these results confirming the observations of DAVIS [see above].

With regard to the testing of monkeys and human beings for immunity to yellow fever it is recommended that the serum should not be collected until 30 days following infection, as the results are likely to be more reliable.

E. H.

FROBISHER (Martin), Jr. **Antigens and Methods for performing the Complement-Fixation Test for Yellow Fever.**—*Amer. Jl. Hyg.* 1931. Mar. Vol. 13. No. 2. pp. 585–613. [13 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

This paper is mainly concerned with attempts to find a more satisfactory antigen for use in complement fixation tests for the diagnosis

of yellow fever. As previously recorded by the author [this *Bulletin*, Vol. 26, p. 1004], antigen prepared from the livers of monkeys dead of yellow fever, and extracted by the use of hypertonic salt solution or freezing and thawing were found to be the most satisfactory. These extracts tended to become anticomplementary when stored in cotton stoppered flasks, but in sealed ampoules could be preserved for several months. Attempts to "reconstruct" old antigens were unsatisfactory. Heating to 56° C. destroyed liver antigens. Eosin, even in high dilutions, produced strong anticomplementary properties, and the use of alcohol to inactivate the virus is inadvisable because of the formation of anticomplementary precipitates. Liver that had been desiccated *in vacuo* and stored for some time acted as an antigen but was not so satisfactory as fresh liver. The majority of monkey sera were found to contain relatively large amounts of anti-sheep amboceptor; this may be a possible cause of some of the falsely negative tests. The sera of infected monkeys collected during the early febrile stage served as satisfactory antigens, but were not so good as the best liver antigens. Berkefeld filtrates of saline extracts of infected mosquitoes gave strong reactions with immune monkey sera. Normal mosquitoes also reacted to some extent as antigen but gave non-specific results.

The injection of small amounts of monkey protein, such as vaccine, into human beings may give rise to confusion when complement fixation tests are made in which monkey tissue extracts are used as antigen; for the injection of human serum into monkeys was found to engender antibodies which fixed complement when an antigen of human serum was used.

E. H.

FROBISHER (Martin), Jr. **Further Observations on the Filtrability of Yellow Fever Virus.**—*Amer. Jl. Trop. Med.* 1931. Mar. Vol. 11. No. 2. pp. 127–137. [12 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

The mosquito virus was found capable of passing through Berkefeld "V" filters suspended in distilled water (pH 6·4), physiological sodium chloride solution (pH 6·2), or phosphate buffer solution (pH 7·8), but in all cases the suspension had been made less than ten minutes before filtration, owing to the instability of mosquito virus in aqueous fluids. Hydrogen ion concentrations between 4·8 and 7·8 did not seem to differ greatly in their detrimental effect upon the virus.

The author's experiments suggest that as soon as the virus is inactivated it undergoes chemical or physical changes interfering with its adsorption, and various theories are discussed concerning the influence of serum on the virus.

Of special interest are the results of the inoculation of mosquito virus (unfiltered) obtained by grinding up infected mosquitoes in distilled water. One of these monkeys died of yellow fever on the 23rd day without showing any fever; another only showed fever on the 28th day and the animal died 5 days later with typical gross lesions; a third monkey showed no fever until the 31st day and died two days later with typical gross and microscopical lesions.

E. H.

KERR (J. A.). **Use of Icterus Index and Bromsulphalein Test in Experimental Yellow Fever.**—*Amer. Jl. Trop. Med.* 1931. Mar. Vol. 11. No. 2. pp. 139–143. [2 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

The author has investigated the value of these two tests, making about 600 determinations of each on 114 rhesus monkeys infected with yellow fever. An icterus index in these animals, of 10 or more units on the second day of fever and of 15 or more on the third and fourth days, was found to indicate a fatal prognosis. With values less than these a mortality of 12 to 23 per cent. may be expected. In the bromsulphalein liver function test, the retention of 10 per cent. or more of the dye on the second day of fever, and of 15 per cent. or more on the third day, indicated a fatal infection. With values less than these a mortality of 35 per cent. may be expected. The icterus index was found to be the more accurate of these tests, and also much easier to determine.

E. H.

WAKEMAN (A. Maurice) & MORRELL (Clare A.). **Chemistry and Metabolism in Experimental Yellow Fever in** *Macacus rhesus* **Monkeys. III. Blood Sugar and Liver Glycogen.**—*Arch. Intern. Med.* 1931. Jan. Vol. 47. No. 1. pp. 104–115. With 2 charts in text. [16 refs.]

This is the third part of the authors' observations on the chemistry and metabolism of experimental yellow fever in monkeys [for preceding reports see this *Bulletin*, Vol. 27, p. 876 and Vol. 28, p. 293]. By examining monkeys at different stages of the disease and grouping the results it is clearly shown that hypoglycaemia is regularly present in yellow fever monkeys 24 hours before death and becomes more pronounced towards the end. In every case tested the blood sugar finally fell to a level at which convulsions might have been expected, less than 45 mgm. per 100 cc.; nevertheless definite symptoms of hypoglycaemic shock were not observed and intravenous injections of dextrose had no obvious beneficial action [see FINDLAY and HINDLE, *loc. cit.* p. 293].

Hypoglycaemic shock was found to be difficult to produce in monkeys. After hypoglycaemia had appeared, little glycogen was found in the livers of yellow fever monkeys, and the hyperglycaemic action of epinephrine was greatly diminished or abolished. The change in the carbohydrate system preceded the deaminization and urea formation previously described.

E. H.

DINGER (J. E.). Gelbfieber bei weissen Mäusen. [**Yellow Fever in White Mice.**]—*Zent. f. Bakt.* I. Abt. Orig. 1931. June 24. Vol. 121. No. 3/4. pp. 194–212. With 4 text figs. [12 refs.] [Roy. Colonial Inst., Amsterdam.]

The author has confirmed THEILER's observation [see this *Bulletin*, Vol. 27, p. 872] as to the susceptibility of mice to intracerebral inoculation with yellow fever virus and gives details of the pathological changes observed in infected mice. When mice are inoculated intracerebrally the lethality is generally 100 per cent.; other methods of

inoculation are less certain, and the brain may fail to show any sign of infection and the animal remains susceptible. As found by THEILER, the virus is strongly neurotropic and no matter what form of inoculation is employed can only be recovered from the nervous system and the suprarenals. The author was unable to find any specific eosinophile inclusions in the ganglion cells of infected mice.

Various attempts were made to filter the mouse virus, and when the infected brains were suspended in physiological saline the results were negative; later the addition of 10 per cent. rabbit serum to these suspensions showed that the mouse virus would readily pass through filters, the previous failures presumably being due to the deleterious action of the saline.

This effect was also observed in some experiments to determine the influence of immune serum on mouse infections. The earlier attempts gave very uncertain results, but when the virus was suspended in 10 per cent. rabbit serum, then passed through a Seitz filter and mixed with various sera before the mixture was inoculated intracerebrally into mice, different results were obtained. Yellow fever immune serum prevented the development of any encephalitis or other symptoms of yellow fever in the inoculated mice, whilst those inoculated with a mixture of virus and normal serum all died with typical signs of the disease.

Monkeys were inoculated with the brain emulsions of infected mice after 1, 2, 3, 4, 8, 12 and 18 mouse passages respectively, and all developed typical yellow fever, no diminution in virulence being observed. It is noted that infected mice should be killed about the 8th day, as there seems to be a slight falling off in the infectivity of the brain just before death. The infection produced in monkeys by the mouse virus shows no neurotropic characters, but is of the typical septicaemic type.

Of especial interest are the author's experiments with mosquitoes, which were successfully infected by feeding them on a serum suspension of the brains of infected mice at the 10th to 12th passage. These mosquitoes were fed on rhesus monkeys 26 days later and produced typical infections of yellow fever.

E. H.

THEILER (Max). **Neutralization Tests with Immune Yellow Fever Sera and a Strain of Yellow Fever Virus adapted to Mice.**—*Ann. Trop. Med. & Parasit.* 1931. Mar. 31. Vol. 25. No. 1. pp. 69–77. [1 ref.] [Harvard Med. School, Boston.]

The author has made neutralization tests in mice with 13 human immune yellow fever sera. The tests were made by mixing the immune serum with varying strengths of a virus suspension, prepared by breaking up the brain of a mouse dying after intracerebral injection of passage virus, and inoculating the mixture intracerebrally, either immediately, or after standing at room temperature for some time. A mixture of equal parts of serum and 1 : 100 virus kept at room temperature gave satisfactory results, and it is shown that when tested in mice all the sera showed a greater or less degree of protection.

E. H.

MONTEIRO (J. Lemos). Sobrevivencia do virus amarillico no organismo de certos animaes domesticos. [**Survival of the Yellow Fever Virus in Certain Domestic Animals.**]—*Brasil-Medico.* 1930. Sept. 27. Vol. 44. No. 39. pp. 1087–1093. With 4 charts in text. [1 ref.] English summary. [Butantan Inst., Butantan.]

The author investigated the question of the possible survival of the virus of yellow fever in animals living in close contact with man. He inoculated a dog subcutaneously with virus from a *Macacus rhesus.* Three days later he injected 5 cc. of the heart blood of the dog into another rhesus ; 21 days later he inoculated the latter with yellow fever virus which killed a control in 8 days. The monkey sickened some weeks later but this was due to tuberculosis, no signs of yellow fever being found post mortem. Twenty-three days after the first inoculation the dog was given another dose of virus (emulsion of infective liver of rhesus) ; 4 days later 5 cc. of its blood was inoculated into a rhesus which after a further interval of 20 days was inoculated with virus, as in the former experiment, and proved to be immune. Ten days after the second inoculation of the dog, 5 cc. of its blood was injected into a rhesus, and 14 days later the monkey was given a dose of the virus which produced a non-fatal attack of yellow fever.

The experiments with cats were also of great interest ; the following scheme represents the results of one series :—

Cat 1.

Inoculated intraperitoneally with virus, July 5. Bled on 12th and 30th days after. Fever from 8th to 16th days after inoculation then return to normal.

M. rhesus 106. Inoculated with blood of cat on July 17. Died of yellow fever in 9 days.

Cat 4. Inoculated with 4 cc. of blood of Cat 1 on July 17. Bled on Aug. 4 and blood injected into

M. rhesus 115. Inoculated with active virus on Aug. 26. Proved immune.

M. rhesus 114. Inoculated with 5 cc. of blood of Cat 1 on Aug. 4. On Aug. 26 inoculated with active virus. Immune.

M. rhesus 109. Inoculated on July 25 with blood from 106. Died in 4 days from yellow fever.

M. rhesus 110. Inoculated on July 26 with emulsion of liver of 106. Died of yellow fever in 3 days.

Cat 5. Inoculated on July 25 with 4 cc. of blood of 106. Bled in 11 days and blood (5 cc.) inoculated into.

M. rhesus 117. On Aug. 5. On Aug. 26 inoculated with active virus. Proved immune.

The following are the conclusions drawn :

1. Yellow fever virus injected into the dog remains for a few days in the body and its blood injected into a *M. rhesus* sets up a febrile reaction after which the monkey is immune.

2. Injected into the cat the virus causes, after 8 days' incubation, a febrile reaction, and its blood after 12 days transmits a typical and fatal infection to rhesus ; after 30 days the virus from the cat will bring about immunity of the rhesus.

3. These animals may, therefore, play an important part epidemiologically, as carriers of the virus.

H. H. S.

DINGER (J. E.), SCHÜFFNER (W. A. P.), SNIJDERS (E. P.) & SWELLENGREBEL (N. H.). Onderzoek over gele koorts in Nederland. (Zesde (laatste) mededeeling.) [**Yellow Fever Research in Holland. Sixth and Last Communication.**]—*Nederl. Tijdschr. v. Geneesk.* 1931. June 6. 75th Year. 1st Half. No. 23. pp. 2964–2972. [64 refs.]

In this article the present position is summarized regarding (1) the susceptibility to and character of the infection produced in various species of animals, and (2) the immunity attainable by means of vaccine or by modification of the virus with passage or through allied diseases. The *Macacus rhesus* is not the only monkey which may be used as a test animal; other species have been shown to be more or less susceptible. In guineapigs the bite of the mosquito and intraperitoneal inoculation of filtered and unfiltered blood and organ emulsions produced an infection which was fatal in 50 per cent. of cases. A typical yellow fever could be produced in the rhesus monkey with material of the first guineapig passage but not with subsequent passages. The disease was devoid of symptoms in the guineapig and of more than one month's incubation. THEILER's discovery that white mice can be infected by intracerebral inoculation was confirmed: all the animals die, usually within 8 days, from acute encephalitis often accompanied by gastric haemorrhages, fatty degeneration of the liver and swelling of the adrenals. The virus is essentially neurotropic in this animal and is distributed throughout the nervous tissues. Thus the virus of yellow fever produces a different type of disease in monkeys, guineapigs and white mice respectively.

No support is forthcoming for the view of KUCZYNSKI that the cause of yellow fever is the bacillus named *B. hepatodystrophicans*. The virus of yellow fever is still unknown; it is present in filtrable form in the blood of man and monkey, in the mosquito, in the guineapig and in the brain of the mouse.

The immunity developed by an attack of yellow fever is high and of long duration. HINDLE's work with virus vaccine is referred to as not yet being completely satisfactory. The question is raised by the authors whether a yellow fever virus, which is living but attenuated for man by passage through another species of animal, might not be the most serviceable for immunization. Comparison is made with the small pox virus, while the finding of new test animals is regarded as bringing the possibility nearer attainment. Experiments by the authors with infected mosquitoes which were kept for some days or weeks at a low temperature before being used to infect monkeys seemed to point to the development in these animals of an immunity without their having shown symptoms of illness. There is suggested in this experiment then the possibility of a mode of safe immunization with modified living virus. A third possibility of immunization through modified living virus is considered under the head of the immunity produced by an allied disease. Thus eleven rhesus monkeys which

had recovered from an infection with dengue virus were subjected to infection by a lethal yellow fever virus. Eight of these monkeys remained alive. This experiment is very suggestive of the immunity conferred by at least one allied disease [see above, p. 718].

W. F. Harvey.

DAVIS (Nelson C.). **The Transmission of Yellow Fever. On the Possibility of Immunity in Stegomyia Mosquitoes.**—*Amer. Jl. Trop. Med.* 1931. Jan. Vol. 11. No. 1. pp. 31–42. [3 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

In an attempt to discover whether yellow fever virus was persisting in the absence of recognized cases, monkeys were inoculated with the contents of *Aedes aegypti* caught in houses in Bahia. The results were negative. Experiments were then made on the possible influence of the ingestion of immune blood by mosquitoes. It was found that mosquitoes fed on immune blood, which had been digested, gave rise to no immunity when injected into or fed upon rhesus monkeys, and moreover became infective when subsequently fed on a yellow fever animal. In mosquitoes which had already digested a meal of infectious blood, the subsequent ingestion of immune blood had no influence on the development of infectivity. Two batches ot mosquitoes fed on a mixture of virus and immune serum did nof become infective, although the mixture itself produced yellow fever when inoculated into a monkey. [These results afford an independent confirmation of those previously recorded by the reviewer (*ante*, p. 285).]

E. H.

DAVIS (Nelson C.). Estudos sobre febre amarella. O effeito do calor e do frio sobre o desenvolvimento da infectividade nos *Aedes aegypti*. [**Studies on Yellow Fever. The Effects of Temperature on Infectivity of** *Aedes aegypti*.]—*Brasil-Medico.* 1931. Jan. 24. Vol. 45. No. 4. pp. 77–78. [2 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

The author here summarizes the results of a large number of experiments, details of which are to be published elsewhere [not stated]. The mosquitoes were kept in an atmosphere saturated with moisture, so that relative humidity would not affect the results. Immediately after feeding on an infected animal they were subjected to the temperature in question. The results are given as follows [translated] :

1. Mosquitoes kept for 2 days at 38° C., then for 2 days at 36° C. (i.e., 4 days at an average of 37° C.) and then allowed to bite a susceptible animal, set up fatal yellow fever.

2. After 5 days at 36° C., mosquitoes were infective. Two tests were made ; one rhesus died, the other had a febrile attack, recovered, and was non-infectable afterwards.

3. After 6 days at 31° C. (with occasional drop to 30·5° C.) a fatal infection was caused.

4. After 8 days at room temperature (about 25° C.) they set up fatal infections.

5. After 30 days at 18° C. they were non-infective, but after another 6 days at the temperature of the laboratory, they became infective. HINDLE recorded infection after 20 days at 18° C. (this *Bulletin*, Vol. 28,

p. 285), but the author allowed 60 to bite after 20 days and 80 after 30 days at 18° C., with completely negative results. One monkey had slight fever, after a long interval, but not yellow fever, since its blood was non-infective and itself proved susceptible to inoculation of virus.

6. Mosquitoes kept at 8° C. for 28 days were not infective, but after 18 hours at room temperature and 6 days at 36° C., their bite caused fatal yellow fever.

7. Those kept at 36° C. for 5–7 days on biting set up fatal infection; after 20 days non-fatal infection, but the blood of this last caused fatal disease both by direct inoculation and indirect by mosquito.

8. Mosquitoes kept for 7 hours at 40° C. and then at room temperature were allowed to bite 17 and 28 days later, 50 or more at a time; non-fatal infection was caused. Thirteen mosquitoes belonging to the same lot, but which had not been subjected to the high temperature, set up rapidly fatal yellow fever after 28 days.

9. Six mosquitoes which survived exposure to 45° C. for 2 hours and were then kept at room temperature for 15 days, produced fatal infection in a rhesus at the end of this period.

10. The experiments showed that the virus in mosquitoes was not attenuated at temperatures down to 8° C., but prolonged exposures to high temperatures led to some degree of attenuation. Mosquitoes themselves are very susceptible to high temperatures and die before the virus which they harbour is destroyed.

H. H. S.

Davis (Nelson C.) & Shannon (Raymond C.). **Studies on Yellow Fever in South America. Attempts to transmit the Virus with Certain Aedine and Sabethine Mosquitoes and with Triatomas (Hemiptera).**—*Amer. Jl. Trop. Med.* 1931. Jan. Vol. 11. No. 1. pp. 21–29. [6 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

These experiments extend the number of mosquitoes found capable of transmitting yellow fever under laboratory conditions. *Aedes fluviatilis*, a species which breeds in rock holes along stream beds, was found to be a fairly efficient carrier, as in 11 trials there were at least 8, and probably 9 infections. A fatal infection by bite was obtained with as few as three insects. *Aedes taeniorhynchus* breeds in pools near the sea coast. Although a much less efficient host than the former, in one case out of 10 experiments a fatal infection was produced by their bites, and also the virus survived in the bodies of this species as proved by injection. Eight experiments with Sabethine mosquitoes (*Wyeomyia* sp. and *Limatus*) gave negative results; in 7 instances the bodies of the mosquitoes were injected. A few inconclusive experiments were made with *Triatoma megista*; in one instance it was thought that the virus had remained alive in the bodies of these insects for one week. [The evidence, however, is not very convincing.]

E. H.

Davis (Nelson C.). **The Transmission of Yellow Fever. Further Experiments with Monkeys of the New World.**—*Amer. Jl. Trop. Med.* 1931. Mar. Vol. 11. No. 2. pp. 113–125. [7 refs.] [Yellow Fever Lab., Internat. Health Division, Rockefeller Foundation, Bahia, Brazil.]

The author gives the records of attempts to infect other species of Brazilian monkeys with yellow fever. A red howler monkey,

Alouatta seniculus, was infected by mosquito bites, and its blood was infective to rhesus monkeys by direct inoculation, and also to mosquitoes fed upon it during the access of fever. This monkey recovered and its serum was protective when tested in another animal. Two *Callicebus moloch* were inoculated; one developed immunity without showing any signs of disease, whilst the other had fever on the fifth day and its blood became infective. One owl monkey, *Aotus trivirgatus*, was bitten by infected mosquitoes; it showed no fever, but developed immune bodies in the blood. Three red-faced monkeys, *Cacajao rubicundus*', were found to be resistant; but the serum of one of them protected against virus both before and after the inoculation of infectious material. Two Saki monkeys, *Pithecia monacha*, were infected one with blood virus and the other with mosquito virus and the infection was transmitted back to *M. rhesus*. The serum of these recovered Saki monkeys showed very little protective value when subsequently tested. One *Cebus variegatus* was infected by mosquito bites and the virus recovered from its blood. Its convalescent serum was strongly protective. A spider monkey, *Ateles ater*, became infective on the 4th day after being inoculated with virus; 3 cc. of its convalescent serum failed to protect a test animal (rhesus). This spider monkey and one of the Sakis were reinoculated with virus; from neither of them was it possible to recover virus from the blood from the 4th day onwards.

E. H.

SNIJDERS (E. P.) & DINGER (J. E.). Die pathologisch-anatomische Diagnose des Gelbfiebers bei Affen. [**The Pathological-Anatomical Diagnosis of Yellow Fever in Monkeys.**]—Reprinted from *Virchows Arch. f. Path. Anat. u. Physiol.* 1931. Mar. 12. Vol. 280. No. 2. pp. 444–462. With 17 text figs. [17 refs.] [Colonial Inst., Amsterdam.]

The authors' account of the postmortem changes observed in a series of rhesus and cynomolgus monkeys infected with yellow fever, agree in general with those of other observers. Of especial interest is the section dealing with the histological changes with reference to the intranuclear inclusion bodies in the liver and their diagnostic value. Although they agree as to their importance, these bodies are not considered to indicate the presence of virus in the nuclei, but rather to be the result of specific degenerative changes produced in the course of the disease. Two monkeys killed by phosphorus poisoning did not show these bodies in the liver, although distinct necrosis as well as diffuse fatty degeneration was present.

Protection experiments were made in six monkeys with convalescent sera from six cases of five-day fever from the Dutch East Indies, to see if these sera contained any immune bodies against yellow fever. The results were uniformly negative.

E. H.

MAGALHAES (Aggeu de Godoy). **The Kidneys in Yellow Fever.**—*Arch. Pathology.* 1931. Apr. Vol. 11. No. 4. pp. 561–573. With 4 figs. (2 coloured). [17 refs.] [Path. Dept., Univ., Toronto.]

The author describes the changes in the kidney in yellow fever, based on the examination of 87 human cases and 34 monkeys. His

results agree in the main with previous observations but the following points are noteworthy: (1) fatty degeneration usually plays a minor part in the degenerative changes; (2) the calcareous casts contain iron; (3) some of the nuclei of degenerating cells contain acidophil homogeneous hyaline inclusions, sharply isolated in an empty clear space; (4) other nuclei show some form of degeneration as manifested by solidification into compact hyaline masses which subsequently break up into granules; these gradually fuse with the cytoplasm which in such cases is found to be undergoing hyaline and granular disintegration.

[The acidophil inclusions are evidently identical with those found in the kidneys of monkeys and wild rats by HINDLE and STEVENSON.*]

E. H.

MANTEUFEL (Paul) & HERZBERG (Kurt). Weitere Untersuchungen ueber die Bedeutung des *Bacillus hepatodystrophicans* (Kuczynski) für die Gelbfieberätiologie. III. Mitteilung. [**Further Studies on the Significance of** *B. hepatodystrophicans* **in the Aetiology of Yellow Fever.**]—*Klin. Woch.* 1931. Feb. 28. Vol. 10. No. 9. pp. 395–397. [6 refs.] [Hyg. Inst., Med. Acad., Düsseldorf.]

The present article contains further evidence as to the nature of this organism which the authors consider to be identical with *Bacterium renale* [see this *Bulletin*, Vol. 27, p. 877]. The organs of normal monkeys were found to contain this organism, as demonstrated by cultivation for 10 to 16 days of pieces of either liver or kidney from these animals in the special culture media used by Kuczynski. With one monkey 5 out of 50 pieces of liver gave positive results, and with another 2 out of 44. Using kidney 4 out of 20 were positive. Since this *Bacterium renale* has thus been cultivated from normal monkeys and is indistinguishable from *B. hepatodystrophicans*, the authors consider that this organism is not the cause of yellow fever, but merely a harmless commensal. *B. lymphophilus*, found by BLOOMFIELD and TORREY† in human lymph glands, is mentioned as a similar organism, as it occurs in normal individuals and has no obvious pathogenic effect.

It would seem that there is a group of similar micro-organisms that are able to grow anaerobically but find their optimum with an air pressure of 30–100 mm. of mercury. On passage, the cultures can be grown aerobically in Löffler's serum, but not on blood agar. [In view of the authors' results, combined with those of other workers, there can no longer be any doubt that the so-called *B. hepatodystrophicans*, described by KUCZYNSKI as the causative organism of yellow fever, is merely a harmless commensal.]

E. H.

HOFFMANN (W. H.). Fortschritte der Gelbfieberforschung.—Reprinted from *Zent. f. d. ges. Hygiene.* 1931. Vol. 23. No. 13/14. pp. 641–656. [37 refs.] [Finlay Inst., Havana, Cuba.]

RHO (Filippo). Nefriti e nefrosi e la caratteristica epatonefrosi della febbre gialla.—*Ann. di Med. Nav. e Colon.* 1931. Mar.-Apr. Year 37. Vol. 1. No. 3–4. pp. 121–127. [2 refs.]

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* *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1930, Vol. 23, p. 327.

† Torrey (1916)—*Jl. Med. Res.* Vol. 34, p. 65.

RELAPSING FEVER AND OTHER SPIROCHAETOSES.

LEAGUE OF NATIONS MONTHLY EPIDEMIOLOGICAL REPORT. 1930. Dec. 15. Vol. 9. No. 12. pp. 481–490. With 1 map. [19 refs.]—**Relapsing Fever** (*Spirochaeta obermeieri*) [*S. recurrentis*] **from 1920 to 1930.** [In parallel French & English.]

An interesting review of the epidemiology of relapsing fever showing the remarkable diminution in the number of cases in Europe and North Africa during the past ten years. The persistence of endemic foci in both Italy and especially Russia, however, still constitutes a source of danger, for it is well known how rapidly this disease can assume epidemic proportions during wars and famines. Contrasting with this post-war decline in European countries, an extensive and deadly epidemic spread from Kouroussa, French Guinea, in 1921, throughout Equatorial Africa between 10° and 15° N., and the number of deaths caused during the first two years in the French Sudan and Niger was estimated at 80,000 to 100,000. Endemic foci still persist in all the savanna area south of the Sahara, where the inhabitants wear clothing and are infested with lice, but the disease does not occur among the naked tribes such as those of the equatorial forest.

Figures are also given of other epidemics, including those in Asia. It is shown that the fatality rate is generally higher in Africa than in Europe, and it is suggested that differences in the virulence of the causative agent of the disease in the various epidemics play an essential part, in addition to differences in the resistance of the population, determined by their physical well-being or conditions of nourishment.

E. Hindle.

RUSSELL (Helen). **Human and Experimental Relapsing Fever, Accra, Gold Coast, 1929–1930.**—*West African Med. Jl.* Lagos. 1931. Jan. Vol. 4. No. 3. pp. 59–66. With 6 folding charts.

The author has studied cases of relapsing fever occurring in the Gold Coast during 1929 and 1930. Attention is drawn to the difficulty of distinguishing relapsing fever in this colony from other diseases accompanied by toxic jaundice, when spirochaetes have disappeared from the blood. There is no single characteristic pathological lesion or group of lesions, but diagnosis has to be made largely by a process of exclusion. Spirochaetes may sometimes be found in lice collected from patients after the spirochaetes have disappeared from the blood. Spirochaetes from 41 cases of relapsing fever from three localities were typed with known sera, and found to be identical with those of the previous year. The pouched rat, *C. gambianus*, was the most satisfactory experimental animal for use in Accra. With this strain of relapsing fever the course of the disease was usually one attack and one relapse ; occasionally a second relapse was observed. Spirochaetes were obtained from the seemingly negative blood between the original attack and relapse by subinoculation into normal rats ; these " first interval " spirochaetes were of the relapse type. Alternation of the original attack type and relapse type spirochaetes occurred on passage from rat to rat. The types did not alternate in the same individual animal. Rats which had recovered from infection with one of the types remained resistant to reinfection with that type for months, but could be infected with any other type. Splenectomy before

infection increased the death rate to some extent but did not prevent the development of immunity; when performed after recovery it did not cause any reappearance of spirochaetes.

Spirochaetolysins specific to the type or types of spirochaetes with which the animal was infected, were found in the serum for months after infection, but in gradually waning strength.

E. H.

NICOLLE (Charles), ANDERSON (Charles) & LE CHUITON (F.). Sur l'existence, en Tunisie, de la fièvre récurrente espagnole. [**The Presence of Spanish Relapsing Fever in Tunis.**]—*C.R. Acad. Sci.* 1931. Jan. 26. Vol. 192. No. 4. pp. 194–196. [1 ref.]

——, —— & ——. Sur un cas de fièvre récurrente espagnole, observé en Tunisie.—*Arch. Inst. Pasteur de Tunis.* 1931. Apr. Vol. 20. No. 1. pp. 1–20. With 1 map & 2 charts in text. [Refs. in footnotes.]

Since *Ornithodorus erraticus* occurs in the Mediterranean region from Spain to Egypt, it was to be expected that the Spanish strain of relapsing fever, conveyed by this tick, would eventually be found in Algeria and Tunis. The present note contains a record of such a case in a patient who came from the neighbourhood of Bizerta. The pathogenicity of the strain was studied in laboratory animals and transmission experiments made with *O. erraticus* and *O. savignyi*. As usual, only the nymphs could transmit the infection by their bite, although both nymphs and adults became infected. The infection was not transmitted by lice. Evidence is adduced in support of the view that the smaller rodents, and not porcupines, may serve as the natural reservoir of the virus.

The second article contains full details of the various animal experiments and observations on this strain.

In an appendix it is mentioned that the number of strains of relapsing fever spirochaetes kept at the Pasteur Institute of Tunis has been reduced to four, viz. (1) *S. duttoni*, strain Ouzilleau from a human case; (2) *S. normandi*, from the burrows of small rodents at Kef; (3) *S. hispanica* of Mansouria, from Ornithodorus in the burrows of small rodents in Morocco; (4) *S. hispanica* from Sidi-Salem (human case). These four strains are generously placed at the disposal of any laboratory desiring to use them.

E. H.

NICOLLE (Charles) & ANDERSON (Charles). Rapport sur les spirochètes des fièvres récurrentes, transmises par les tiques. [**A Report on Relapsing Fever Spirochaetes transmitted by Ticks.**]—*Arch. Inst. Pasteur de Tunis.* 1930. Dec. Vol. 19. No. 4. pp. 469–477. [1 ref.]

A useful summary of the authors' main conclusions concerning this subject. Three distinct groups are recognized: (1) the uniform *duttoni* group, virulent to rats and mice, but having hardly any pathogenic action in guineapigs; (2) the *hispanica* group, equally pathogenic to guineapigs, rats and mice; (3) a group of spirochaetes found in small rodents, including *S. normandi*, *S. erratici*, *S. gondii*, hardly pathogenic to guineapigs and rats, but capable of infecting mice. In human beings these spirochaetes produce either a non-apparent infec-

tion (*S. normandi*) or none at all (*S. gondii*). It is pointed out that the *duttoni* group of spirochaetes is by far the most dangerous to man, and yet with few exceptions *S. duttoni* has been selected when relapsing fever has been used therapeutically for the treatment of general paralysis. The authors recommend the use of spirochaetes of the *hispanica* group, which produce an equally definite fever but are infinitely less dangerous.

E. H.

FRANCHINI (Giuseppe) & TADDIA (Leo). Febbre da puntura di zecche in Cirenaica causata dalla "Ornithodorus Franchinii" (n. sp.). [**Tick-Bite Fever in Cyrenaica caused by** *Ornithodorus franchinii* **(n. sp.).**]—*Arch. Ital. Sci. Med. Colon.* 1930. Aug. 1. Vol. 11. No. 8. pp. 453–458. With 1 text fig. English summary (7 lines).

In December, 1929, several patients, seen at Porto Bardia, reported that while tending sheep they were overtaken by a heavy fall of rain and took shelter in a small grotto where were many rats and ticks. The men were bitten by ticks and within 3 days or so they were seized with intense headache, high fever, vomiting and severe general malaise. Occasionally furuncles appeared and if the bite was on or near the scrotum a frequent complication was an epididymo-orchitis. Otherwise the symptoms cleared up in a week. The ticks were thought to be *O. lahorensis*, but Dr. TONELLI-RONDELLI, to whom specimens were sent, reported that they belonged to a new species which he named *O. franchinii*. [The points of distinction are not stated but the ticks are depicted in a photograph.]

H. H. S.

MEDULLA (Candido). La posizione della Cirenaica nella distribuzione della febbre ricorrente del Nord Africa. [**Cyrenaica and Relapsing Fever in Northern Africa.**]—*Arch. Ital. Sci. Med. Colon.* 1931. Apr. 1. Vol. 12. No. 4. pp. 230–232. [1 ref.] English summary (6 lines). [Colonial Hosp., Benghazi.]

True relapsing fever appears to be rare in Cyrenaica, but there are other febrile conditions of a relapsing type which call for study. In Benghazi and the uplands in the late summer and early autumn cases are seen resembling some dengue, some pappataci fever, and others presenting up to three relapses at intervals of a few days. These have been, on inadequate grounds, diagnosed as relapsing fever, but careful examination of blood taken at all stages of the attack has failed to reveal the spirochaete and Barce is probably the only endemic centre of true relapsing fever.

H. H. S.

CHU (Fu-T'ang), DEITRICK (Sarah) & CHUNG (Shih-Fan). **Relapsing Fever in Children. A Study of Twenty-Six Epidemic Cases.**—*Nat. Med. Jl. China.* 1931. Apr. Vol. 17. No. 2. pp. 224–232. With 1 plate. [15 refs.] [Peiping Union Med. College, Peking.]

A study of 26 cases of relapsing fever in children in Peking. Although a widespread petechial rash was commonly present this may have been the result of the bites of insects, as these are a probable aetiological factor. The leucocyte count was of little value, varying between 4,100 and 19,600 in the febrile stage. Thrombocytopenia was constantly observed during the febrile attacks, the number of platelets

falling below 100,000, but after recovery the platelet count returned to normal or nearly normal, 200,000 to 300,000. No prolongation of the bleeding or coagulation time was noticed. The Wassermann reaction was negative in all except one case and the globulin precipitation test was negative in the 14 cases in which it was done. The icterus index fell within the range of 5 to 10 units in ten cases, this agreeing with the clinical observation of lack of jaundice or of hepatic enlargement in this series. The intravenous injection of 0·2 to 0·3 gm. of novarsenobenzol caused the disappearance of spirochaetes and of all febrile symptoms in less than 28 hours; all the patients recovered.

E. H.

MENK (W.). Ueber die chemotherapeutische Wirkung von Goldverbindungen bei der mit der *Spirochaeta crocidurae* infizierten Maus, unter besonderer Berücksichtigung der Behandlung mit Neosalvarsan-Solganalgemischen. [**The Chemotherapeutic Action of Gold Compounds in Mice infected with** *S. crocidurae* [= *duttoni*], **especially Treatment with Mixtures of Neosalvarsan and Solganal.**] —*Arch. f. Schiffs- u. Trop.-Hyg.* 1931. Feb. Vol. 35. No. 2. pp. 97–107. [40 refs.] [Reich Health Office, Berlin-Dahlem.]

The author has tested the therapeutic action of a number of compounds on mice infected with the Senegal strain of *S. duttoni*, often called *S. crocidurae*. The blood of the mice was examined for spirochaetes during three weeks after the treatment and finally in most cases the infectivity of the brain was tested by subinoculation into other animals. The results show that a mixture of neosalvarsan and solganal gives a considerable increase in therapeutic efficiency without increasing the toxicity. A single injection of a mixture of $\frac{1}{3}$ to $\frac{1}{4}$ the dosis tolerata of solganal and about $\frac{1}{3}$ the dosis tolerata of neosalvarsan regularly cured mice, and even when these doses were reduced to $\frac{1}{16}$ and $\frac{1}{8}$, respectively, the majority were cured. Consequently this mixture is recommended for the treatment of human spirochaetal infections, including syphilis.

E. H.

BASKIN (M. M.). Die Heilwirkung des Triphals bei Infektion mit verschiedenen Stämmen der Recurrensspirochäte. [**The Therapeutic Action of "Triphal" on Various Strains of Relapsing Fever Spirochaetes.**]—*Klin. Woch.* 1931. May 9. Vol. 10. No. 19. pp. 886–888. [5 refs.] [Microbiol. Research Inst., Education Commissariat R.S.F.S.R., Moscow.]

The author tested the action of triphal, a gold compound, on mice infected with *S. recurrentis* and four strains of *S. duttoni*, respectively. The results indicate that triphal is a slightly more efficient drug than salvarsan, since although there was no marked difference in the respective effects on the parasites in the blood, those treated with the former showed a smaller percentage of persistent brain infections than those treated with salvarsan, the respective figures being 5·1 and 16·4.

Experiments showed that this gold preparation acts through the reticulo-endothelial system, for the injection of colloidal iron or splenectomy prevented the development of its full therapeutic action.

E. H.

KAWAMURA (H.). Experimentelle Untersuchungen ueber Misch- und Sekundärinfektion. I. Ueber den Einfluss einer experimentellen Rekurrensinfektion auf eine Infektion mit andersartigen Rekurrensspirochäten oder mit Trypanosomen. [**Experimental Studies on Mixed and Secondary Infections. I. Influence of Experimental Relapsing Fever on Infection with Another Type of Relapsing Fever or with Trypanosomes.**]—*Zent. f. Bakt.* I. Abt. Orig. 1931. Feb. 23. Vol. 120. No. 1/2. pp. 59–78. [91 refs.] [Reich Health Office, Berlin-Dahlem.]

The possibility of one infection influencing another in the same host is discussed in a lengthy introduction and then the author describes various experiments on this problem. Mice were inoculated with a strain of *S. duttoni* var. *crocidurae* and 24 or 48 hours later with a strain of *S. hispanica,* or conversely, first with *S. hispanica* and later with the *crocidurae* strain ; other mice were inoculated with the two strains simultaneously. The results show that although the mixed infections persisted longer in the blood of the mice than either of the infections alone, there was no very definite evidence of the respective virulence of the strains being affected, although there was distinct evidence of the attacks being delayed. Both strains of spirochaetes were recovered from the brains of mice after the parasites had disappeared from the circulation.

In another series of experiments mice were infected with strains of *S. hispanica* and *Trypanosoma brucei* or *S. crocidurae* and *T. brucei,* either simultaneously, or the spirochaetes first, followed at intervals of 1 to 9 days by the trypanosomes. The results show that mice infected with this strain of *T. brucei* and two days later with *S. hispanica* died in four days, but when the trypanosomes were inoculated simultaneously the animal did not die until the 22nd day. Intermediate durations were obtained when the trypanosomes were inoculated after the spirochaetes. If the spirochaetes were removed from the circulation by a dose of 1/150 gm. solganal, the trypanosomes rapidly multiplied and killed the mouse within 6 or 7 days, whilst untreated mice with similar mixed infections survived 24 and 25 days respectively. When mice had previously been " blockaded," or splenectomized, the spirochaetes had the same effect on the trypanosomes. According to the author the spirochaete acts by strengthening the natural resistance of the organism against the trypanosome infection, as shown by the development of various relapse strains of trypanosomes in the mice with mixed infections. It is considered possible that in the treatment of paralysis, etc., by the use of acute infections, these act by stimulating the natural protective mechanism of the body.

E. H.

VELU (H.), BALOZET (L.) & ZOTTNER (G.). Infections mixtes trypano-spirochétiennes (*Trypanosoma marocanum* + *Spirochaeta hispanicum*). [**Mixed Infections of** *Trypanosoma marocanum* **and** *Spirochaeta hispanica.*]—*C.R. Soc. Biol.* 1931. Apr. 24. Vol. 106. No. 12. pp. 1092–1094. [8 refs.]

Guineapigs that had recovered from infection with this spirochaete were subsequently inoculated with *Trypanosoma marocanum* ; in one animal the spirochaetes did not reappear, but in another that had also been splenectomized, the spirochaetes reappeared in the blood 154

days after the original inoculation and 49 days after the inoculation of trypanosomes. When the two were inoculated simultaneously the spirochaetes had no effect on the development of the trypanosome infection, and vice versa, the trypanosome did not noticeably affect the spirochaetes, although there may have been fewer and shorter relapses [see above].

E. H.

DUBOIS (A.). Pluralité des souches chez *Spirochaeta duttoni*. [**Plurality of Strains in** *S. duttoni*.]—*C.R. Soc. Biol.* 1931. May 1. Vol. 106. No. 13. pp. 1294–1297. [3 refs.] [School of Trop. Med., Brussels.]

The author has compared two strains of *S. duttoni* from the Congo, both obtained from infected Ornithodorus. One of these strains, known as Kitega, came from the lake region, and the other—Kwango—has been kept in the laboratory for years. The Kitega strain is hardly ever fatal to mice, but regularly produces a persistent brain infection, which is evidently a natural property and not confined to old laboratory strains. A comparison of these two strains by means of cross immunity experiments in mice showed that recovery from one strain did not protect against infection with the other strain.

E. H.

MATHIS (C.) & DURIEUX (C.). Entretien, au laboratoire, des souches de *Spirochaeta duttoni*. [**The Maintenance in the Laboratory of Strains of** *S. duttoni*.]—*Bull. Soc. Path. Exot.* 1931. Feb. 11. Vol. 24. No. 2. pp. 150–153. [Pasteur Inst., Dakar.]

In order to reduce the number of animal passages necessary for the maintenance of this strain in the laboratory, the authors recommend the inoculation of brain emulsions instead of blood. It is well known that the infection persists in the brain long after it has disappeared from the blood, and consequently instead of having to passage every 4 to 6 days, it is only necessary to do it every 3 or 4 weeks. The infection produced by the inoculation of brain suspensions is less intense and may not appear until the sixth day. However, at any time, by inoculating the blood from any of these milder cases into normal mice, intense and fatal infections are produced.

E. H.

SEMZOVA (O. M.). Ueber die Wirkung exogener Einflüsse auf den Neurotropismus der Rekurrensspirochäten. II. Der Einfluss von Alkohol auf die Persistenz der Rekurrensspirochäten im Gehirn weisser Mäuse. [**Action of External Influences on Neurotropism of Relapsing Fever Spirochaetes. II. Influence of Alcohol on Persistence of Relapsing Fever Spirochaetes in Brains of White Mice.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1931. Vol. 70. No. 1/2. pp. 104–107. [7 refs.] [Microbiol. Research Inst., Education Commissariat R.S.F.S.R., Moscow.]

White mice which had been given 0·3 cc. of 15 per cent. alcohol *per os* daily for periods of two weeks, three weeks, and 45 days respectively, were

then injected with a strain of *S. duttoni*. They were subsequently examined for persistent brain infections 39 to 46 days later, as well as a series of control mice similarly infected. Out of 70 " alcoholic " mice, 26 showed brain infections, whilst out of 36 normal mice only 7 showed brain infections. Consequently alcohol seems to have doubled the chance of residual brain infections, the respective percentages being 37·1 and 19·4.

E. H.

VELU (H.), BALOZET (L.) & ZOTTNER (G.). Apparition de la virulence du cerveau chez les cobayes inoculés avec le spirochète hispano-marocain. [**Development of Virulence in Brain of Guineapigs inoculated with Spirochaetes of Moroccan Relapsing Fever.**]—*C.R. Soc. Biol.* 1931. Apr. 24. Vol. 106. No. 12. pp. 1089–1091. [3 refs.]

Guineapigs were inoculated with this strain of relapsing fever in order to determine whether the brain had any particular affinity for the spirochaetes, as determined by killing these inoculated animals at varying intervals after the injection and testing the infectivity of the brain. The results show that no matter what method of inoculation is employed, including intracerebral, the spleen becomes infective at least as quickly as the brain, and it would seem that the spirochaetes commonly persist in the brain because of the weakness of the defence mechanism in that part of the body.

E. H.

VELU (H.), BALOZET (L.) & ZOTTNER (G.). Influence de la splénectomie dans l'infection expérimentale par *Spirochaeta hispanicum*. [**Influence of Splenectomy in Experimental Infections with** *S. hispanica*.]—*C.R. Soc. Biol.* 1931. Apr. 16. Vol. 106. No. 11. pp. 890–892. [5 refs.]

——, —— & ——. Influence du blocage du système réticulo-endothélial dans l'infection expérimentale par *Spirochaeta hispanicum*. [**Influence of blockading the Reticulo-Endothelial System in Experimental Infections with** *S. hispanica*.]—*Ibid.* p. 892. [1 ref.]

Splenectomy practised either before or after infection with *S. hispanica* was found to have no effect on the course of the disease. Moreover it did not cause the reappearance of spirochaetes in animals that had recovered from infection. Blockage of the reticulo-endothelial system of guineapigs with latent brain infections also did not cause the spirochaetes to reappear in the circulation.

E. H.

DELANOË (P.). Le mérion, réservoir de virus du spirochète marocain, *Sp. hispanicum* var. *marocanum* Nicolle et Anderson, 1928. [**The Merion, Reservoir of Moroccan Spirochaete,** *S. hispanica* **var.** *marocana*.]—*C.R. Acad. Sci.* 1931. Apr. 7. Vol. 192. No. 14. pp. 859–860.

A record of the examination of 21 *Meriones shawi* collected in the neighbourhood of Oulad Fredj. By means of inoculation into guineapigs 2 out of these 21 animals were found to be infected with the Moroccan strain of Spanish relapsing fever, so evidently they are capable of acting as reservoir for the virus, in addition to the fox and the porcupine.

E. H.

PAMPANA (Emilio J.). Note di tecnica nello studio delle spirochetosi. La spirochetosi sperimentale da *Treponema hispanicum* nella cavia. [**Examination of Blood for Spirochaetes. Experimental Spirochaetosis in Guineapigs.**]—*Arch. Ital. Sci. Med. Colon.* 1931. May 1. Vol. 12. No. 5. pp. 257–263. [3 refs.] English summary (3 lines). [Hyg. Inst., Univ., Rome.]

To facilitate search for spirochaetes in the blood, the following solution is recommended :

Methylene blue (B extra) 2 gm. ; distilled water 100 cc. ; dissolve with gentle heat, shake, filter and add formalin 4 cc. and glacial acetic acid 10 cc. The blood is taken in a thick drop, dried rapidly by holding over the microscope lamp ; the stain is poured on and allowed to act for 10 minutes, then rapidly washed in running water, blotted and dried. Spirochaetes and nuclei of leucocytes stain blue and show out clearly amid unstained surroundings. The solution keeps for months and acts with old as well as fresh specimens, the high concentration of acetic acid giving complete dehaemoglobinization.

The second part of this communication describes a mode of maintaining *S. hispanica* (used in place of malaria therapy) without the necessity of frequent inoculation of animals. The author finds that infections with this spirochaete are markedly neurotropic in the guineapig, the brain and cerebellum being still infective 14 months after the primary inoculation, and possibly longer. To ensure maintenance of a strain, the guineapig is killed by chloroform 6 months after being infected, the brain and cerebellum are removed aseptically, thoroughly and repeatedly washed with sterile physiological saline to remove as much as possible all blood and serum, and then emulsified in saline. To infect a fresh guineapig 1 cc. is injected subcutaneously or intraperitoneally. In 6–12 days spirochaetes will be found in the circulation, the length of the intervening period depending largely on the age of the brain emulsion.

H. H. S.

KRITSCHEWSKI (I. L.) & SINJUSCHINA (M. N.). Ueber die Natur der Immunität bei Rückfallfieber. XIII. Ueber die Wechselbeziehungen der humoralen und der phagozytären Abwehrapparate des Organismus bei Rückfallfieber. [**Nature of Immunity in Relapsing Fever. XIII. Changes in the Humoral and Phagocytic Protective Mechanism of the Body in Relapsing Fever.**]—*Krankheitsforschung.* 1931. Apr. Vol. 9. No. 2. pp. 139–166. With 11 text figs. [Refs. in footnotes.] [Microbiol. Research Inst., Education Commissariat R.S.F.S.R., Moscow.]

The authors find that in animals infected with relapsing fever, lysis of the spirochaetes is by far the most important factor in the termination of the infection whilst phagocytosis is only observed very occasionally. But when immune animals are reinoculated either subcutaneously or intraperitoneally both antibodies and phagocytes take part in the destruction of the spirochaetes, granulocytes and monocytes very actively ingesting these organisms. This phagocytosis, however, is only observed in immune animals inoculated in this manner ; if such an animal is inoculated intravenously, the spirochaetes are destroyed by the action of lysins without the aid of phagocytosis.

E. H.

MARCHOUX (E.) & CHORINE (V.). Culture des spirochètes de la poule. [**The Culture of Fowl Spirochaetes.**]—*C.R. Soc. Biol.* 1931. Apr. 24. Vol. 106. No. 12. pp. 1125–1128. [2 refs.]

The authors have made various experiments to determine the most satisfactory method of cultivating fowl spirochaetes and recommend the following medium :

(1) Horse serum heated three times for 30 minutes at 57–58° C. (or rabbit or bovine serum similarly heated 20 cc.) ... 10 cc.
(2) Sterile physiological saline at 9 per 1,000 ... ... 100 cc.
(3) Sterile 10 per cent. solution of Witte's or Chapoteaut's peptone ... ... 2 cc.
(4) A 2 per cent. solution of glycogen sterilized by filtration ... 5 cc.

This mixture should have a pH of 7·5 to 7·7 and is run into tubes containing slopes of coagulated egg albumen. The liquid is then covered with a layer of oil or vaseline 1 cm. in thickness. Cultures are grown at 37° C. and the primary cultures only succeed when rabbit serum is used in preparing the medium. After four or five passages the rabbit serum can be replaced by other sera, such as those of the horse, ox, or man.

E. H.

TOYODA (H.). **Relapsing Fever.**—*Nat. Med. Jl. China.* 1931. Apr. Vol. 17. No. 2. pp. 233–267. With 8 figs. on 2 plates & 1 text fig. [46 refs.]

A general review of the subject in which points of especial interest are the author's references to observations on Manchurian relapsing fever.

E. H.

VELU (H.), BALOZET (L.) & ZOTTNER (G.). Contribution à l'étude expérimentale de *Spirocheta hispanicum* (var. *marocanum*). [**Experimental Study of** *S. hispanica* (**var.** *marocana*).]—*Arch. Inst. Pasteur de Tunis.* 1931. Apr. Vol. 20. No. 1. pp. 21–47. [37 refs.]

The detailed observations recorded in this paper confirm the results of previous observations concerning a variety of problems on the behaviour of this spirochaete in a large series of experimental animals.

E. H.

TIMPANO (P.). Casi di broncospirochetosi in Calabria. Note epidemiologiche e clinicodiagnostiche. [**Bronchial Spirochaetosis in Calabria.**]—*Policlinico.* Sez. Prat. 1931. June 8. Vol. 38. No. 23. pp. 804–808. With 3 text figs. [23 refs.] [Diagnostic Inst., Reggio Calabria.]

The author states that he has observed four cases of bronchial spirochaetosis and gives the details of one.

H. H. S.

NEUDA (Paul). Gibt es eine Gestaltänderung bei Spirochäten ?—*Wien. Klin. Woch.* 1931. May 1. Vol. 44. No. 18. pp. 578–579. [3 refs.]

LEPTOSPIROSIS.

TAYLOR (J.) & GOYLE (Amar Nath). **Leptospirosis in the Andamans (with an Appendix on the Present Knowledge of Leptospiral Infections).**—*Indian Med. Res. Memoirs. Supplementary Series to Indian Jl. Med. Res.* 1931. Mar. Memoir No. 20. pp. v+190. With 8 charts, 3 maps & 2 plates. [4 pages of refs.] [Pasteur Inst. of Burma, Rangoon.]

This memoir constitutes a valuable addition to our knowledge of this disease, but it is only possible to refer to the authors' main conclusions. The leptospiral nature of epidemic jaundice in the Andamans has been confirmed by the examination of 64 cases during 5 months, all of which gave a positive serological test or a positive blood culture. The cases varied from the mildest non-icteric type to severe fatal cases showing all the characteristics of Weil's disease. The mortality of this epidemic was 18·7 per cent. Blood culture was found to be the most reliable method of diagnosis and was usually positive during the first five or six days of the disease. Serological confirmation of the disease could often be obtained after the 15th day.

In the Andamans the disease is prevalent during the south-west monsoon and cases are practically confined to adult males engaged in outdoor occupations which involve working in water and mud for long periods. The infection is widely scattered and does not as a rule show any marked intensity in any one area, although there was one outbreak of 19 cases with 4 deaths, which occurred within 3 weeks in a gang employed in the construction of a bund in swampy ground. The onset of the first case was 6 days after the beginning of the work and the last case was 8 days after construction had stopped.

Samples of standing water from different localities showed variations in pH from 7·6 to below 6·6. Leptospira was found in most water samples showing a reaction of pH 6·9 or over and was absent from those below 6·9. Rats were found to be absent from the infected fields during the epidemic season of the monsoon. A small number obtained from certain areas showed no leptospira in their kidneys. The leptospira strains isolated belonged to two distinct serological types: 24 were distinct from any known type and have been called "Andamans A"; the remaining 4 were agglutinated by *Akiyami* A antisera, but in addition showed a specific agglutination with their own anti-serum.

The cultures of "Andamans A" group were of low pathogenicity for adult guineapigs but young ones (about 120 gm.) could be infected by intraperitoneal injections of 3 cc. of a rich culture. Virulence for guineapigs was increased by subsequent passages using liver emulsions and eventually adult guineapigs were infected. The other strains related to Akiyami A were not found to be pathogenic to young guineapigs.

The second part of the memoir contains a useful summary of the present knowledge of leptospiral infections.

E. Hindle.

PAWAN (J. L.). *Leptospira ictero-haemorrhagiae* **in Rats in Trinidad, B.W.I.**—*Ann. Trop. Med. & Parasit.* 1931. Mar. 31. Vol. 25. No. 1. pp. 31–33. [4 refs.]

This spirochaete was found in 32 out of 120 (26·6 per cent.) rats examined in Trinidad. All the strains, except two, were pathogenic

to guineapigs and were readily cultured. The incidence of the infection was highest in the older and heavier rats.

E. H.

GARNIER (Marcel), NICAUD (P.) & MAISLER (A.). Spirochétose méningée pure à rechute.—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1931. May 25. Year 47. 3rd Ser. No. 17. pp. 869–875. [6 refs.]

LAIGNEL-LAVASTINE (M.), BOQUIEN (Y.) & PUYMARTIN (Ch.). Spirochétose méningée anictérique.—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1931. May 25. Year 47. 3rd Ser. No. 17. pp. 802–806. [2 refs.]

LOYGUE & LEMOINE. Ictère spirochétosique. Action probable "in vivo" de la gonacrine sur la virulence du spirochète.—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1931. Feb. 2. Year 47. 3rd Ser. No. 3. pp. 119–122. With 1 chart in text.

O'CONNOR (M. H.). Spirochaetal Jaundice.—*Irish Jl. Med. Sci.* 1931. May. No. 65. pp. 214–221. [15 refs.]

SLOT (J. A.). Myeloiede reactie en haemoglobinurie als verwikkeling bij de ziekte van Weil.—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1931. Jan. 1. Vol. 71. No. 1. pp. 48–51. With 1 chart in text.

TARASSOFF (Serge). Note additionnelle sur l'agent infectieux de la schlammfieber ou Leptospirosis grippo-typhosa aquatilis.—*Ann. Inst. Pasteur.* 1931. June. Vol. 46. No. 6. pp. 635–638.

TOMITA (S.). Klinische Untersuchungen ueber die Liquor cerebrospinalis bei Spirochaetosis icterohaemorrhagica.—*Fukuoka-Ikwadaigaku-Zasshi* (*Fukuoka Acta Med.*). 1930. Mar. Vol. 23. No. 3. [In Japanese. German summary pp. 21–22.] [1st Med. Clinic, Imperial Kyushu Univ., Fukuoka, Japan.]

TOMITA (S.). Experimentelle Untersuchungen ueber den Liquor cerebrospinalis bei Spirochaetosis icterohaemorrhagica.—*Fukuoka-Ikwadaigaku-Zasshi* (*Fukuoka Acta Med.*). 1930. Aug. Vol. 23. No. 8. [In Japanese. German summary pp. 67–68.] [1st Med. Clinic, Med. Faculty, Imperial Kyushu Univ., Fukuoka, Japan.]

TOMITA (S.). Experimentelle Untersuchungen ueber die Durchlässigkeit der Meningen bei Spirochaetosis icterohämorrhagica.—*Fukuoka-Ikwadaigaku-Zasshi* (*Fukuoka Acta Med.*). 1930. Sept. Vol. 23. No. 9. [In Japanese. German summary pp. 69–70.] [1st Med. Clinic, Imperial Kyushu Univ., Fukuoka, Japan.]

RABIES.

A REVIEW OF RECENT ARTICLES. XV.*

i. *Virus.*

REMLINGER and BAILLY,[1, 2] in a most interesting communication, describe and discuss the confusion which has arisen on various occasions between the rabies virus and other neurotropic viruses. The evidence on either side is given in illuminating detail in each instance and cannot be condensed in a review. They conclude (1) that the virus of KORITSCHONER (*Wien. Klin. Woch.*, 1923, p. 385) was a slightly modified rabies virus. (2) That the encephalytic virus of KOBAYASHI was, as shown by COWDRY'S experiments (this *Bulletin*, Vol. 24, p. 762), without doubt a rabies virus. (3) That the herpetic virus DK of NICOLAU and KOPCIOWSKA (this *Bulletin*, Vol. 27, p. 251) was of the same category. (4) The identity of the virus ECK (SILBERSTEIN) remains in suspense. Of the animal viruses: (1) that of the state of Santa Catherina (CARINI: *Annales de l'Institut Pasteur*, 1911, pp. 843–846) which caused an epidemic amongst cattle, horses and mules, but, curiously, was not transmitted to man or dogs, was not a rabies virus: the symptoms were those of a pseudo-bulbar paralysis, or "maladie d'Aujesky." (2) The same appeared to be the case in the endemic in the state of Rio Grande do Sul. On the other hand (3) the acute contagious encephalitis of cattle (DONATIEN and BOSSELUT, *Rev. Gen. de Med. vet.*, 1922, pp. 185–191) was really rabies, as also was (4) the meningo-myelitis of young dogs (REMLINGER and BAILLY). The authors discuss the means by which such confusion may be avoided. The presence of Negri bodies cannot be depended upon, as inclusion bodies are a common feature of virus diseases on the one hand, and on the other they may not be found in rabies. Experimental inoculation is of great importance especially if a series of passages is made. The resistance of the virus to anti-sera may be tested and finally the method of crossed immunity may be employed. The authors draw attention to the recommendation of the International Conference on Rabies (Paris, 1927) that researches should be carried out on the plurality of street and fixed virus, and state that there has as yet been no response to this suggestion.

A comparative examination of the characteristics of the fixed viruses of Sassari and Odessa has been made by PALAWANDOW and SEREBRENNAJA.[3] They believe that for purposes of comparison it is sufficient to determine the minimum lethal dose by subdural inoculation, and by subcutaneous injection. Other characteristics such as resistance to drying, to glycerine, to phenol, etc., they believe to be

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* For the fourteenth of this series see Vol. 28, pp. 243–257.

1 REMLINGER (P.) & BAILLY (J.). Les confusions entre les virus neurotropes et le virus rabique. Moyens de les éviter.—*Bull. Acad. Méd.* 1930. Dec. 30. Year 94. 3rd Ser. Vol. 104. No. 42. pp. 771–785. [17 refs.] [Pasteur Inst., Tangiers.]

2 REMLINGER (P.) & BAILLY (J.). Les confusions entre les virus neurotropes et le virus rabique. Moyens de les éviter.—*Bull. Inst. Pasteur.* 1931. Jan. 15. Vol. 29. No. 1. pp. 1–13. [20 refs.] [Pasteur Inst., Tangiers.]

3 PALAWANDOW (Haidar) & SEREBRENNAJA (A. I.). Beitrag zum Vergleich biologischer Eigenschaften der Stämme des Virus fixe Sassari mit dem Odessaer Virus fixe.—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1930. Vol. 69. No. 3/4. pp. 267–276. [19 refs.] [Bact. Inst., Odessa.]

secondary, and dependent on these two primary factors. Parallel tests, carried out on 157 rabbits with the Odessa virus, and 227 with the Sassari virus showed that the Odessa was somewhat stronger. The minimal lethal doses were 0·000008 gm. (Odessa) and 0·000025 gm. (Sassari). By subcutaneous injection of rabbits it appeared that the Odessa virus was virulent in a dose of 0·05 gm. (12½ per cent. mortality), whilst the Sassari killed in a dose of only 0·5 gm. (1 per cent. mortality).

REMLINGER (*Ann. de l'Inst. Pasteur*, 1918, p. 406) drew attention to the rare presence of rabies virus in the spleens of rabid guineapigs (8 times in 42 cases). REMLINGER and BAILLY[4] have repeated these experiments in other animals. The following are the results: In the rabbit, 3 positive in 16 tests; in the cat, 7 positive in 15 tests; in the dog, 2 positive in 7 tests; in the rat none positive in 5 tests. Thus in 12 out of a total of 43 tests (28 per cent.) a positive result was obtained. The authors believe that this result is explained by the work of MANOUÉLIAN and VIALA (this *Bulletin*, Vol. 25, p. 707), who showed that the virus in salivary and other glands is present in the neurones of the ganglia. The achievement of a positive result is thus due to the chance inclusion of neurones containing parasites. An argument in favour of this opinion is that in the case of the cat in which the peripheral nervous system is exceptionally developed, the percentage of successes was higher than in the dog and in the rabbit.

In a second paper REMLINGER and BAILLY[5] show that the livers of various animals dead of rabies, may contain rabies virus. The results were as follows: of 9 cats 5 were positive. Of 6 rabbits one was positive. Of 4 rats and one dog none were positive. In these experiments various strains of virus were used. The kidneys were also examined. In the case of the cats 5 were positive, of the 6 rabbits one was positive, of 2 dogs, 2 rats and one guineapig none were positive. Again the largest proportion of successes related to the cat.

CURASSON and DISCHAMPS[6] have succeeded in passaging the virus used by DABBADIE (this *Bulletin*, Vol. 28, p. 243), through eleven generations (using the cynocephalus as test animal), without any alteration in virulence. As the virus in question was undoubtedly autochthonous, these experiments afford a further argument in favour of the identity of the virus of French West Africa with that of rabies. The authors recommend the use of the cynocephalus as an experimental animal as it is easy to procure in these regions.

The evidence regarding the occurrence of rabies in South Africa is presented, in a concise but exhaustive review by DU TOIT.[7] As the matter is of great interest his summary may be quoted verbatim.

"In 1892 rabies was introduced into South Africa [by an Airedale terrier which had been imported] and spread in and around Port Elizabeth.

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[4] REMLINGER (P.) & BAILLY (J.). Présence du virus rabique dans la rate.—*C.R. Soc. Biol.* 1931. May 1. Vol. 106. No. 13. pp. 1204–1205. [1 ref.] [Pasteur Inst. of Morocco, Tangiers.]

[5] REMLINGER (P.) & BAILLY (J.). Présence du virus rabique dans le foie et dans le rein.—*C.R. Soc. Biol.* 1931. May 22. Vol. 107. No. 16. pp. 201–202. [1 ref.] [Pasteur Inst. of Morocco, Tangiers.]

[6] CURASSON (G.) & DISCHAMPS (A.). Au sujet de l'unicité de la rage en Afrique Occidentale Française.—*Bull. Soc. Path. Exot.* 1931. Feb. 11. Vol. 24. No. 2. pp. 154–155. [1 ref.]

[7] DU TOIT (P. J.). Rabies in South Africa.—*Pan-African Agric. & Vet. Conference, Pretoria, 1-17 Aug. 1929. (Papers Vet. Sect.).* pp. 272–284. [15 refs.]

It was eradicated in less than a year, and, since then, until quite recently, the Union of South Africa was considered free of the disease. Southern Rhodesia was infected with rabies from 1902 to 1913, but no cases have been recorded since the latter year. Since 1916 a number of cases have been observed in human beings in the Union of South Africa, which, clinically, appeared to be typical rabies. In none of these cases could the diagnosis be confirmed by microscopical examination or biological tests. In November, 1928, two further cases occurred in boys who had been bitten by a yellow mongoose ('rooi meerkat,' *Cynictus penicillata*). The diagnosis of rabies was confirmed by an examination of the brains of the boys. Rabies was also diagnosed in yellow mongoose caught on the veld, and which appeared to be sick. Cases are recorded of a dog and an ox which contracted rabies, apparently as the result of being bitten by infected yellow mongoose. Rabies has further been diagnosed in a genet cat ('Muskejaatkat,' *Genetta felina*); and cases are recorded of human beings becoming infected with rabies after being bitten (or scratched) by this animal. There is no evidence at present to show that other wild animals in South Africa, besides the two mentioned, harbour the rabies infection. The infected area appears to stretch from the eastern Transvaal to Bechuanaland (Vryburg) in the west and the northern Cape (De Aar) in the south. The area probably embraces the whole of the Orange Free State.

"The most remarkable feature about the disease in South Africa is the fact that it has not spread among the dog population. The question arises whether we are dealing with true rabies or not. Points in favour of the view that it is true rabies are :—(*a*) The susceptibility of human beings, dogs and laboratory animals. (*b*) The symptoms observed in these. (*c*) The presence of typical Negri bodies in the brain. Points against the view that it is true rabies are :—(*a*) The fact that in nature it has been confined to wild carnivores (of the family *Viverridae*). (*b*) That it has shown no tendency to spread among the dogs. Apparently the infection has become somewhat modified during its sojourn in the wild carnivores.

"The origin of the present infection is unknown, neither is it certain how long the disease has been present in South Africa. Certain facts seem to indicate that the infection is of comparatively recent origin and that it is spreading. The control of the disease in South Africa presents unusual difficulties. The eradication of the yellow mongoose and the genet cat is practically impossible. Their numbers should, however, be reduced. In the infected areas the number of dogs should also be restricted and all ownerless dogs destroyed. In view of the comparatively dormant state of the disease in South Africa, it is desirable to continue to prohibit the importation of dogs from countries where rabies exists."

ii. *Symptomatology.*

v. Löte[8] describes a case of recurrent rabies in a rabbit, which in the course of a passage experiment had been inoculated with the brain of a rabbit which died of typical rabies on the 7th day. No symptoms other than recurrent rises of temperature were observed, and these continued up to the 106th day. From the 106th to the 206th day there was no rise of temperature. An operation was performed on two occasions entailing the excision of a small portion of brain substance, and as a result of the second operation the rabbit died. Its brain was examined, and small Negri bodies were found. A rabbit inoculated with the portion of brain excised on the 48th day died

[8] v. Löte (Josef). Ueber einen Fall von rückfallender Tollwut (Lyssa recurrens) bei Kaninchen.—*Zent. f. Bakt.* I. Abt. Orig. 1931. Feb. 23. Vol. 120. No. 1/2. pp. 86–89. [1 ref.] [General Path. & Therap. Inst., Franz Joseph Univ., Szegedin.]

on the 18th day of typical rabies. Another inoculated with brain excised on the 206th day died 114 days afterwards with typical rabies, i.e., after a protracted incubation. A rabbit inoculated with brain substance taken after death died of typical rabies after 140 days. From these observations the author considers that in this case there was evidence of a definite tendency towards cure.

TORPY[9] describes the symptoms and course of a case of hydrophobia.

iii. *Diagnosis.*

In a previous review (this *Bulletin*, Vol. 27, p. 254), reference was made to the view of KOCH (Jos.) that the distribution of rabies virus in the brain was uneven, and that for diagnostic purposes various parts of the brain should be examined. REMLINGER and BAILLY[10] have submitted this to the test. From 10 animals 63 samples of nervous material were taken at different levels of the brain and cord. Emulsions of these samples were inoculated into 63 rabbits, 57 of which developed rabies. KOCH's statement is thus substantiated, though the chance of non-success is small. The authors suggest that from the practical point of view instead of subinoculations from various samples, it would be simpler to make up a larger quantity of emulsion from a large volume of brain, and to use a sample of the mixture.

THOMAS and JACKSON[11] emphasize the importance of searching for Negri bodies in the *nucleus oculomotorius*. Figures are given relating to 70 rabbits' brains examined in South Africa. (The authors admit the remote and unlikely possibility that the South African strain of rabies may differ from that of other countries.) Of the 70, 49 were clinically positive, and 48 were positive histologically. In 25 cases (51 per cent.) Negri bodies were more frequent in the mid brain than in the hippocampus. In only 1 (2 per cent.) were they more frequent in the latter than in the former. In 11 cases (22 per cent.) Negri bodies were absent in the hippocampus but present in the mid brain, and in 1 case (2 per cent.) they were absent in the mid brain, but present in the hippocampus.

"The best level at which to cut the mid brain section appears to be at the anterior extremity of the posterior *corpora quadrigemina*. At this point the *nucleus ruber* lies in the most dorsal part of the *formatio reticularis*, immediately below and against the *nucleus oculomotorius*." The authors believe that by this method the proportion of incorrect diagnoses may be materially decreased, and are of opinion that the labour and time spent in routine examination are greatly reduced. "The oculomotor nucleus is easily found, and its whole extent may be covered rapidly owing to its restricted size. All that is necessary is to focus the small group of ganglion cells lying immediately below and on either side of the aqueduct (especially those in the neighbourhood of the small blood vessels which will be

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[9] TORPY (C. D.). A Case of Hydrophobia.—*Indian Med. Gaz.* 1930. Dec. Vol. 65. No. 12. p. 700.

[10] REMLINGER (P.) & BAILLY (J.). Sur l'existence de régions avirulentes dans le système nerveux central de chiens morts de rage.—*C.R. Soc. Biol.* 1931. May 1. Vol. 106. No. 13. pp. 1201–1203. [1 ref.] [Pasteur Inst. of Morocco, Tangiers.]

[11] THOMAS (A. D.) & JACKSON (Cecil). The Value of the Midbrain in the Diagnosis of Rabies in Rabbits.—*Jl. South African Vet. Med. Assoc.* 1930. Oct. Vol. 1. No. 4. pp. 67–73. With 1 text fig. [2 refs.]

seen transected in this region), when, in the great majority of positive cases, Negri bodies will be found immediately." When Negri bodies are rare a wider search may be made. Tissues were embedded in paraffin, and sections stained by methyl blue and eosin. The reviewer would invite those who have access to the necessary material to put these statements to the test and to publish their findings as the matter is of considerable importance.

It will be remembered that LENCI and ESQUIVEL reported that in paralytic rabies in dogs the spleen is hypertrophied, and shows subcapsular haemorrhages, and as a result considered an increase of about four grams per kilo. in the weight of the spleen to be of diagnostic value (this *Bulletin*, Vol. 26, p. 220). D'AUNOY and BEVEN[12] have examined the spleens both grossly and microscopically of 100 rabid and 50 non-rabid dogs and have failed to find any evidence of splenomegaly or of microscopic splenic change which might be considered as pathognomonic.

As the result of his experience in the Italian province of Lecce, CANDIDO[13] emphasizes the importance of the Negri body in the diagnosis of rabies, and the advantage of carbolized vaccines in its treatment.

iv. *Pathology.*

It will be remembered (this *Bulletin*, Vol. 26, p. 222) that REMLINGER and BAILLY failed to demonstrate the least trace of immunity as a result of the treatment of 19 rabbits with desiccated vaccine, and of 17 with ether vaccine, by intracerebral inoculation, whereas MARIE and MUTERMILCH (this *Bulletin*, Vol. 25, p. 709) were able to immunize by the intrameningeal route. LÖFFLER and SCHWEINBURG[14] from an extended series of experiments confirm the former results. They were unable to develop any degree of immunity by intracerebral inoculation. They agree with REMLINGER and BAILLY that intracerebral inoculation differs fundamentally from intrameningeal inoculation, and draw the conclusion that the antibodies to rabies virus, which come into action in the brain after successful intramuscular, subcutaneous, or intra-peritoneal immunization, are not formed in the brain itself but in other organs. This view is opposed to that of LUBINSKI and PRAUSNITZ, who with reference to QUAST's experiment came to the conclusion that the antibodies were produced by the cells of the central nervous system.

Following on previous work (this *Bulletin*, Vol. 26, p. 224), REMLINGER, PALMOWITCH and BAILLY[15] have again failed to substantiate the observation of QUAST that fixed virus passes into the central

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12 D'AUNOY (Rigney) & BEVEN (J. L.). The So-called Splenic Lesions in Canine Rabies.—*Jl. Infect. Dis.* 1931. Mar. Vol. 48. No. 3. pp. 335–336. [1 ref.] [Charity Hosp., & College of Med., Louisiana State Univ., New Orleans.]

13 CANDIDO (G.). Sulla diagnostica della rabbia.—*Riforma Med.* 1931. Mar. 23. Vol. 47. No. 12. pp. 464, 467.

14 LÖFFLER (Ernst) & SCHWEINBURG (Fritz). Zur Theorie der Immunität bei Lyssa.—*Virchows Arch. f. Path. Anat.* 1930. Nov. 10. Vol. 279. No. 1. pp. 181–192. [10 refs.]

15 REMLINGER (P.), PALMOWITCH (S. M.) & BAILLY (J.). Nouveaux faits démontrant que le virus fixe ne passe pas dans le système nerveux central au cours du traitement antirabique.—*C.R. Soc. Biol.* 1931. May 22. Vol. 107. No. 16. pp. 203–204. [3 refs.] [Pasteur Inst. of Morocco, Tangiers.]

nervous system during the course of treatment. During the course of studies on antirabic serum, tests were carried out on a number of animals which had received very large doses of virus. The animals were killed and their brains examined for fixed virus. In every case the result was negative. Further experiments were carried out on 4 dogs and 4 rabbits, each of which had received a full treatment identical with that administered to the most severe human case. Again the results were negative.

It is well known that the blood is not infective in the large majority of cases of rabies, though positive results have been reported from time to time. MARIE and URBAIN[16] have carried out some experiments to find whether the passage of the virus into the blood stream may be facilitated by the administration of various substances which provoke the phenomenon of shock—such as neutral "farine lactée Nestlé," tuberculin, and gonacrine (trypaflavine). The appropriate injection was made into the subarachnoid space, or into the veins of rabbits which had been previously infected with fixed virus, and the blood was tested for virulence by intracerebral injection into rabbits or guineapigs. The most favourable time for administration appeared to be from four to six days after the rabbit had been infected.

In the case of three animals to which "farine lactée" had been administered the blood proved to be infective. In 4 of 11 animals treated with crude tuberculin, a positive result was obtained. A similar result was obtained in 1 out of 3 animals treated with gonacrine. Iodide of potassium and cholesterin were also tested, for other reasons, but apparently they had no action. To summarize: In the case of 32 animals treated by the first three substances, 8 typically positive results were obtained, i.e., 25 per cent. In the case of 7 other test animals from this series symptoms of consumptive rabies occurred.

It is also well known that intravenous injection of passage virus does not lead to infection. Thus failure has been ascribed by many writers to viricidal properties of the serum, etc. JOWELEW[17] has found that by breaking down the haemato-encephalic barrier by pumping, in animals which have received an intravenous dose of fixed virus, the virus finds its way into the brain, and the animal dies of rabies. Simple extraction of the cerebro-spinal fluid is not sufficient.

GLUSMAN and SOLOWJEWA[18] submitted the sera of 70 patients who had been immunized by the Högyes-Philipps method, three weeks after the end of treatment, to serological tests, with the object of determining whether a quantitative relationship exists between the presence of antibodies, and the degree of immunity. The titre of antirabic antibodies, as tested by observing the virulence of mixtures of sera and brain emulsion on inoculated rabbits, was not high, and was sometimes so low that it could not be determined. It was not related to the degree of immunity which had been attained.

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[16] MARIE (A. C.) & URBAIN (Ach.). Virus rabique fixe et virulence du sang.—*C.R. Soc. Biol.* 1931. Jan. 30. Vol. 106. No. 3. pp. 166–168. [1 ref.]

[17] JOWELEW (B. M.). Ueber einige Bedingungen der Impfung mit Tollwut aus dem Blute.—*Ztschr. f. d. gesamte Experim. Med.* 1930. Nov. 5. Vol. 74. Nos. 1-2. pp. 217–223. [15 refs.] [White Russian Microbiol. Inst., Minsk.]

[18] GLUSMAN (M. P.) & SOLOWJEWA (J. W.). Zur Frage der Bedeutung der Virulicidie des Serums für die Beurteilung des Vorhandenseins einer antirabischen Immunität.—*Ztschr. f. Hyg. u. Infektionskr.* 1931. Jan. 15. Vol. 112. No. 1. pp. 40–45. [8 refs.] [Metschnikof Sanit. Bact. Inst., Kharkov.]

v. *Methods of Treatment and Statistics.*

In 1908 REMLINGER showed as the result of experiment that nervous substance does not belong to the category of substances which provoke anaphylactic phenomena. REMLINGER and BAILLY[19] cite in this communication the cases of three individuals, the first of whom had received antirabic treatment by Calmette's method four times during the course of four years, the second three times in four years, and the third two treatments with 17 years' interval. In none of these were any anaphylactic sequelae observed. The repetition of pasteurian treatment may be thus entered upon without anxiety.

The use of herbivora as a source of fixed virus has frequently been referred to in these reviews (this *Bulletin*, Vol. 28, pp. 249–250, etc.). KERBLER[20] from observations on the sheep finds that fixed virus from this animal is as good as that from the rabbit.

Since 1925 the antirabic treatment employed at the Institut Camara Pestana (Lisbon) has been that of killed phenol vaccine. The vaccine contains 5 per cent. of nerve substance, in 1 per cent. phenol heated at 37° C. for 24 hours. The dose is 5 cc., and the duration of treatment is 40 days for severe cases, 30 for medium, 20 for slightly bitten persons, and 15 where the skin has not been broken. The sera of the vaccinated has been tested for the presence of rabicidal substances by DA SILVA[21] in a number of cases. The results are compared with those obtained by the author after treatment by ether vaccines (this *Bulletin*, Vol. 24, p. 229). It appears that if the presence of rabicidal substances is taken as a criterion of efficacy, then ether vaccine confers a more rapid and a more solid immunity than does vaccine killed by phenol, and consequently should be preferred. The ether vaccine has, however, in the author's series of cases, led to one fatal case of myelitis, and has in general caused pain and inconvenience to the patient. As killed phenol vaccines in the dosage employed are inoffensive, easily prepared and administered, and can be sent to outcentres, their employment from the practical point of view is fully justified.

In September, 1928, KELSER published a preliminary note on the use of chloroform-treated vaccine for antirabic inoculation (Vet. Bul., Vet. Corps, Med. Dept., U.S. Army, 1928, xxii, 3). The vaccine was tested by SCHOENING (this *Bulletin*, Vol. 27, p. 754), who found that its potency was greater than that of formolized and phenolized preparations, and suggested that this might be due to the fact that the chloroform vaccine contained 1·6 gm. of nerve substance whilst the phenol vaccine contained only 0·5 gm. A further report is now presented by KELSER.[22] The chloroform content of the vaccine, which contains 33⅓ per cent. of brain substance, has now been increased from 0·75 to 1 per cent. In order to be certain that the vaccine has been killed

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19 REMLINGER (P.) & BAILLY (J.). Innocuité des répétitions du traitement antirabique chez l'homme.—*C.R. Soc. Biol.* 1931. Feb. 27. Vol. 106. No. 7. pp. 523–524. [1 ref.] [Pasteur Inst. of Morocco, Tangiers.]

20 KERBLER (Ferdinand). Ueber die Gewinnung von Virus fixe aus Schafen.—*Zent. f. Bakt.* I. Abt. Orig. 1931. Feb. 3. Vol. 119. No. 7/8. pp. 427–430. With 4 text figs. [Vet. High School, Budapest.]

21 DA SILVA (E. Pereira). Substances rabicides dans le sang des individus vaccinés au virus fixe phéniqué mort.—*Arquivos Inst. Bact. Camara Pestana.* 1930. Vol. 6. No. 2. pp. 138–166. [13 refs.] [Camara Pestana Inst., Lisbon.]

22 KELSER (R. A.). Chloroform-treated Rabies Vaccine.—*Jl. Amer. Vet. Med. Assoc.* 1930. Nov. Vol. 30. No. 5. pp. 595–603. [2 refs.]

it should not be used until it has been kept for at least two weeks, and shaken for approximately five minutes three times a day during this period. From the author's experiments it appears that rabbits can be protected by a single dose of 2 cc. of the vaccine, against a subdural injection with street virus. On a first test 10 of 12 treated rabbits survived, as compared with 2 of 5 controls. On a second test all of 12 treated rabbits survived as against 1 of 5 controls. The author expresses the opinion that "a single dose of 5 cc. for dogs should prove effective against natural infection." He has also found that the filtrate of such a vaccine has no immunizing properties, and suggests that the immunizing principle may result from the reaction between the virus and the tissue cells, or may be a particular "stage" of the virus which occurs only in the tissue cells, and is inseparable from them.

SCHOENING[23] further discusses generally the merits of phenol and chloroform vaccines (this *Bulletin*, Vol. 27, p. 754). Both are safe and efficient; but "no method of vaccination no matter how effective can by itself control outbreaks of rabies. The stray dog is a factor which must always be considered" and legislated against. NEER[24] discussing results in Ohio (U.S.A.) comes to the same conclusion.

The sera of dogs vaccinated by various methods against rabies have been examined by FERREIRA and CONTE.[25] The results which are given in extenso may be summarized as follows. Of those treated by killed vaccines, rabicidal substances were found in the blood from the 10th to the 19th day in 42 per cent. of animals vaccinated. Of those treated by living vaccines the percentage was 50. From the 30th to the 50th day the percentage of the former group declined to 28, whilst in the case of those treated by living vaccines it rose to 62. Antibodies were found in the blood of 42 per cent. of those treated by dead vaccines, and in 21 per cent. of those treated by living vaccines. These results are based on experiments upon 30 dogs, 14 of which were treated with dead vaccines, and 16 with living.

HERRMANN[26] believes that the reduction in mortality which has been observed in a number of institutes during the course of years, depends principally on the fact that patients come more readily for treatment, and so a decrease in the proportion of the severely bitten results. The intensification of treatment apparently also improves results, but it is doubtful if by increasing dosage the period of treatment can be shortened. Experiments show that one and the same dose, if distributed over a number of days, yields a better result than if given on one occasion.

The statistics of anti-rabic treatment at German institutes for the

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[23] SCHOENING (H. W.). Prophylactic Vaccination of Dogs against Rabies.—*Jl. Amer. Vet. Med. Assoc.* 1931. May. Vol. 78. No. 5. pp. 703–707. [7 refs.] [U.S. Dept. of Agric., Washington.]

[24] NEER (Lester C.). Rabies Control in Ohio.—*Jl. Amer. Vet. Med. Assoc.* 1931. May. Vol. 78. No. 5. pp. 708–709. [1 ref.] [Division of Health, Dayton, Ohio.]

[25] FERREIRA (A. Agueda) & CONTE (H. Sá Viana). Recherches des substances rabicides dans le sang des chiens vaccinés contre la rage.—*Arquivos Inst. Bact. Camara Pestana.* 1930. Vol. 6. No. 2. pp. xxvii+1. [19 refs.]

[26] HERRMANN (Otto). Ueber die Intensivierung der Tollwutschutzimpfungen.—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1931. Vol. 70. No. 5/6. pp. 536–540. [7 refs.]

year 1929 are summarized by HESSE.[27] 192 persons were treated at six centres, 86 at Breslau by Semple's method, the remainder by the method of Högyes-Philipps. In every case the treatment was successful. The details of these cases are given on the basis of the schedule issued by the League of Nations, and the first review issued by the League (this *Bulletin*, Vol. 28, p. 247) is discussed.

During the year 1930, 589 persons were successfully treated at the Pasteur Institute of Paris.[28]

The statistics of antirabic treatment at the State Bacteriological Institute at Odessa for the period 1925–1927 are described by PALAWANDOW.[29] The treatment employed was that of Fermi. The number of persons bitten was 4,485, of whom one developed rabies (0·02 per cent.). No complications of any sort or paralyses have followed the treatment. The author compares this with a similar period of three years when an intensive dried cord method was in use, when 6 post-vaccinal paralyses occurred.

During the year 1929, 5,295 patients were treated at the Pasteur Institute of Kasauli[30] (India), and 2,440 at its out-centres. Of those treated at Kasauli 119 died of rabies (2·01 per cent.); of those treated at out-centres 10 died (0·41 per cent.). The difference in the two mortality rates is mainly due to the practice of transferring patients coming to the out-centres, who are severely bitten, to the parent institute. The mortality rate over the combined figures is 1·54 (Indians 1·68 and Europeans 0·14 per cent.). Complete returns after six months were received in respect of 86 per cent. of the patients treated. The test of the relative efficacies of carbolized and etherized vaccines in equal dosage has been carried out throughout the year, and a report of the results obtained is being prepared for publication.

vi. *Post-vaccinal Paralyses.*

From a study of the histological appearances after intracerebral injection of calf lymph virus, on the one hand, and an attenuated rabies virus on the other, GRINKER[31] concludes that "attenuated rabies and vaccinia do not produce the pathological changes found in human post-vaccinal (cow pox and rabies) encephalitis." The post-vaccinal encephalites after vaccination against smallpox and rabies are identical and are of the nature of encephalo-myelites; those produced by calf lymph and attenuated rabies virus are meningo-

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27 HESSE (Erich). Die Tätigkeit der deutschen Wutschutzstationen im Jahre 1929 und die Ergebnisse einer vom Hygienekomitee des Völkerbundes für das Jahr 1928 veranstalteten Erhebung ueber die Wutschutzbehandlung.—*Reichs-Gesundheitsblatt.* 1931. Jan. 7. Vol. 6. No. 1. pp. 3–7. [1 ref.]

28 VIALA (Jules). Les vaccinations antirabiques à l'Institut Pasteur en 1930.—*Ann. Inst. Pasteur.* 1931. May. Vol. 46. No. 5. pp. 574–578.

29 PALAWANDOW (H. B.). Ueber dreijährige Erfahrungen bei Anwendung karbolisierter antirabischer Vaccine nach Fermi an den Pasteurfilialen des Staatl. Bakteriologischen Institutes zu Odessa.—*Seuchenbekämpfung.* Vienna. 1930. Vol. 7. No. 4. pp. 230–236.

30 KASAULI. Pasteur Institute of India. The Twenty-Ninth Annual Report of the Central Committee of the Association and the Audited Accounts up to March 31st 1930, also the Report of the Director of the Institute for the Year 1929 [CRAIGHEAD (A. C.)]. Part II.—62 pp. Simla.

31 GRINKER (Roy R.). Pathology of Experimental Vaccinal and Rabies Encephalitis.—*Proc. Soc. Experim. Biol. & Med.* 1931. Jan. Vol. 28. No. 4. pp. 349–351. [9 refs.] [Med. Dept., Univ., Chicago.]

encephalites. "These findings would seem to suggest that the various types of vaccination and exanthematous diseases in man might act as a stimulant to a latent infection rather than by introducing a specific virus."

SMITH[32] describes a case of post-vaccinal paralysis following treatment at the Pasteur Institute at Kasauli (India). The first symptoms were primarily fever, pain in the back, numbness of both legs, difficulty of micturition. Paralysis of both legs followed, knee jerks were absent. This condition continued for a month and was followed by improvement. At the date of writing (9 months after the onset) the patient was much better, but still impaired in health.

vii. *Rabies in Animals.*

Following on REMLINGER and BAILLY's observations on rabies in the cock, IONESCO[33] describes the case of a child wounded deeply on the face by a cock which exhibited symptoms of fury similar to those described by REMLINGER and BAILLY. The cock was killed, and its brain and cord were examined microscopically. The pathological findings were perivascular haemorrhages, lymphocytic infiltrations and Negri bodies similar to those found by the latter authors. An emulsion of the brain injected subdurally into two rabbits caused paralytic rabies, and in the brains of these, Negri bodies were also demonstrated. A second subpassage was also successful. The author emphasizes the necessity for treating persons bitten in similar circumstances, and draws attention particularly to REMLINGER and BAILLY's observation that the cock may recover after having been infective.

It appears from Moroccan statistics that rabies is 7·57 times as frequent in the male as in the female dog. (Of 70 dogs seen at the Pasteur Institute of Tangiers, 63 were male and 7 female.) REMLINGER and BAILLY[34] in discussing these figures point out that in Tangiers as elsewhere the number of male dogs is greatly in excess (963 dogs as compared with 358 bitches). The difference in the two sets of proportions—7·57 at the Institute and 2·60 under natural conditions—suggests that selection has crept in in some way, and the authors consider that "it is natural to suppose that, other things being equal, rabies is sensibly more frequent in dogs than in bitches." They would be interested to know whether this relation, observed in Morocco, applies equally to other countries.

SCHLINGMAN[35] describes a case of rabies in the dog, which had unusual characteristics. The course of the sickness was protracted to 18 days. The early symptoms were tendency to biting and crossness of temper, which suggested the possibility of rabies infection. On the 15th day slight nervous symptoms appeared; on the 17th day the

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32 SMITH (S.). Paralytic Accidents of Antirabic Treatment.—*Jl. Roy. Army Med. Corps.* 1931. Jan. Vol. 56. No. 1. pp. 14–26. [2 refs.]

33 IONESCO (Demetre). La rage du coq. Application du traitement antirabique à l'homme en cas de morsure.—*Bull. et Mém. Soc. Méd. Hôpit. de Bucarest.* 1930. Oct. Vol. 12. No. 8. pp. 235–237. [2 refs.]

34 REMLINGER (P.) & BAILLY (J.). La rage est-elle plus fréquente chez le chien que chez la chienne ?—*Bull. Acad. Vét. de France.* Paris. 1930. Dec. Vol. 3. No. 10. pp. 443–444.

35 SCHLINGMAN (A. S.). An Unusual Case of Canine Rabies.—*Amer. Jl. Public Health.* 1931. Mar. Vol. 21. No. 3. p. 287. [Research Labs., Parke, Davis & Co., Detroit, Mich.]

nervous symptoms subsided, and next morning the dog was found dead. Negri bodies were found in the hippocampus, and animal inoculations were positive.

AUJESZKY[36] discusses in all its aspects the antirabic treatment both post-infectional and pre-infectional of domestic animals. In cases of the former type he believes that carbolized and etherized vaccines are the most suitable. For the latter he believes that the Japanese method and the quickly dried vaccine of MIESSNER are efficacious in a single dose.

The statistics of vaccination of animals in Morocco are further extended by REMLINGER and BAILLY[37] (see this *Bulletin*, Vol. 27, p. 755, for earlier figures). The number of animals vaccinated after having been bitten now reaches 256 (47 in 1928, 75 in 1929, and 134 in the first nine months of 1930). The number inoculated as a preventive measure were for the same periods 234, 519 and 372, giving a total of 1,125. Ether vaccine, prepared according to the method with which the names of the authors are associated, was employed. The authors are satisfied that with two injections a sufficient degree of immunity is attained. None of the above animals have developed rabies.

After an historical summary of the methods which have been employed for the prophylactic vaccination of dogs, ROSA[38] describes a series of experiments comparing the results obtained with a single injection of vaccine with those obtained after two injections. The test dose in each case was approximately one minimum lethal dose, i.e., one four-hundredth of a gram of street virus administered intra-ocularly. A single injection of killed phenol vaccine did not produce appreciable immunity. A single injection of attenuated vaccine prepared according to the method of UMENO and DOI conferred an immunity which lasted for six months (3 of 7 treated dogs died of rabies as compared with 7 of 7 controls). Two injections of the attenuated vaccine conferred an immunity which lasted for at least nine months (6 of 10 treated dogs contracted rabies, as compared with 9 of 10 controls).

DE PAOLI[38] describes the symptoms and post-mortem appearances observed in the 89 dogs, which had been infected with street virus in ROSA's experiments. Emphasis is laid upon the fact that in 90 per cent. of the dogs, congestion of the gastro-intestinal mucosa was observed, irrespective of whether the animals had died of furious or dumb rabies, thus confirming the observation of PUNTONI (this *Bulletin*, Vol. 25, p. 714). ZAVAGLI[38] describes and illustrates the histopathology of these and other lesions, and concludes that they lend support to the view of PUNTONI that the virus is eliminated from all digestive surfaces, and also to that of MANOUÉLIAN and VIALA that the virulence

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36 AUJESZKY (Aladar). Wutschutzimpfung der Haustiere.—*Deut. Tierärzt. Woch.* 1931. Feb. 21. Vol. 39. No. 8. pp. 113–119.

37 REMLINGER (P.) & BAILLY (J.). La vaccination antirabique des animaux et en particulier la vaccination antirabique du chien.—*Bull. Acad. Vét. de France.* 1930. Oct. Vol. 3. pp. 382–387. [11 refs.]

38 ROSA (Bernardo); DE PAOLI (Pietro); ZAVAGLI (Vittorio). Esperimenti di vaccinazione antirabica dei cani: osservazioni cliniche ed anatomo-patologiche. I. Esperimenti di vaccinazione antirabica dei cani con vaccini fenicata [ROSA]. II. Note cliniche ed anatomo-patologiche sulla rabbia sperimentale nei cani [DE PAOLI]. III. Ricerche isto-anatomo-patologiche nei cani morti di rabbia sperimentali [ZAVAGLI].—*Clinica Vet.* 1930. Nov. Vol. 53. No. 11. pp. 695–725; 726–733. With 5 coloured figs. on 2 plates; 733–742. With 4 figs. on 3 plates.

of the various organs depends upon the presence of parasites contained in the nervous elements which penetrate them (this *Bulletin*, Vol. 25, p. 707).

viii. *Miscellaneous.*

HOYT and JUNGEBLUT[39] have examined the effects of silver arsphenamine, neo-arsphenamine, tryparsamide, Bayer 205 (germanin), optochin and quinine bisulphate, on white mice, which had received an intra-cerebral dose of virus approximating to a minimal lethal dose. Solutions of the drugs were injected into one of the lateral veins of the tail, and treatment was commenced on the day of intra-cerebral inoculation. No prophylactic or therapeutic effects were observed, though the period of incubation consistently showed a very slight prolongation following the injection of silver arsphenamine.

Reference has frequently been made in these reviews to the researches of Marie PHISALIX on the relationship between venins and the virus of rabies. In the present communication[40] she summarizes her researches in a monograph of considerable proportions. The observation that a natural immunity to venoms is usually accompanied by a similar immunity towards rabies virus (e.g., in frogs, snakes, fish of the Murenid family, hedgehog, dormouse, etc.), led her to enquire into its characteristics. The double immunity is independent of temperature, venoms and virus acting at all temperatures compatible with animal life. In the case of the eel, the viper, the hedgehog and the dormouse the immunity is humoral, whilst in the frog it appears to depend upon cellular resistance. The resistance of the *Coluber scalaris* is apparently neither humoral or cellular. In the cases where the double immunity is humoral, the venom antibody is distinct from the rabies antibody, the former being inactivated at a lower temperature (70° C.). The sera of the eel, the viper, and the hedgehog may be employed in place of antivenins and antirabic sera. Also mixtures of virus and serum protect the rabbit against intra-cerebral inoculation with fixed virus. These and other conclusions depend upon a mass of detailed experimentation for which the reader must refer to the original monograph.

DA SILVA[41] describes the cases of six persons bitten by a rabid wolf. Five of these were bitten severely on the head and hands, and the sixth on the hands. The latter died of rabies after a short incubation of 23 days. It appeared from the history of the incident, that the individual who succumbed to the disease had been engaged in a protracted struggle with the wolf, and that, in its course, his wounds had been deluged over a comparatively long period with saliva. In the case of the other five, though they were bitten deeply, the period of contact was short. The explanation suggested is that the quantity of saliva absorbed was greater in the fatal case than in the others.

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39 HOYT (A.) & JUNGEBLUT (C. W.). Experimental Rabies in White Mice and attempted Chemotherapy.—*Jl. Infect. Dis.* 1930. Nov. Vol. 47. No. 5. pp. 418–424. [24 refs.] [College of Physicians & Surgeons, Columbia Univ., New York.]

40 PHISALIX (Marie). Rapports entre les venins et le virus rabique.—Reprinted from *Ann. Sci. Nat., Zool.* 1930. 10th Ser. Vol. 13. pp. 63–128. [63 refs.]

41 DA SILVA (E. Pereira). Sur la pathogénie de la rage (à propos de six cas de morsures graves par un loup enragé).—*Arquivos Inst. Bact. Camara Pestana.* 1930. Vol. 6. No. 2. pp. li+lxxi. [3 refs.]

DA SILVA was able to show that antibodies were present in the blood of 4 of the non-fatal cases, but were absent in the fatal and one of the non-fatal cases. He advises that the sera of all severely bitten persons should be systematically examined.

D. M. GREIG[42] furnishes a scholarly review of BARBIER'S "Les Sources de la Virulence Rabique" (Dijon, 1929).

A. G. McKendrick.

ITABASHI (K.). Studies on the Intraplantar Inoculation of Rabic Virus. I. Experiments with *Virus fixe.—Selected Contributions from Mukden Inst. for Infectious Diseases of Animals.* 1930. Vol. 1. pp. 141–153. [17 refs.] [In Japanese. English summary pp. 223–224.] [See this *Bulletin,* Vol. 27, p. 755.]

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[42] GREIG (David M.). Hydrophobia.—*Edinburgh Med. Jl.* 1930. Dec. Vol. 37. No. 12. pp. 698–705.

MISCELLANEOUS.

JOHNSON (W. B.). **Notes upon a Journey through Certain Belgian, French and British African Dependencies to observe General Medical Organisation and Methods of Trypanosomiasis Control.**—40 pp. With 21 figs. on 7 plates. 1929. Lagos: Govt. Printer.

This article will deal with medical organization only.* The author went by water from Lagos to Matadi in Belgian Congo, thence to Leopoldville, Luebo and Elizabethville; across the northern portion of N. Rhodesia; in Tanganyika Territory to Dodoma and Dar-es-Salaam; across Kenya Colony via Nairobi; across Uganda via Torit and Rejaf and thence down the Nile to England, the whole journey taking 4 months. Between Lagos and Alexandria, 2,540 miles was traversed by boat, 3,070 miles by rail, 4,000 miles by motor lorry and 550 miles by aeroplane.

Native Hospitals and Dispensary Systems.—Two tables give statistics of the medical services of Belgian Congo, Tanganyika, Uganda and Nigeria. Table II is reproduced.

TABLE II.

Country.	Proportion of native patients treated to total population.	Proportion of native patients treated per medical officer (total European plus non-European Medical Officers).
Belgian Congo (State Service (1925)	1 in 38·0	2,207†
Tanganyika (1926)	1 in 13·0	3,279
Uganda (1927)	1 in 6·6	6,270
Nigeria (1927)	1 in 61·8	2,218

† Shows proportion receiving State assistance only and does not include the vast amount of work performed by private companies and religious missions.

The tables show, the author thinks, "that Nigeria is behindhand in this important work for the improvement of the general condition of the population," the main reason being the absence of a trained subordinate staff and of rural and small urban dispensaries. He describes some of the hospitals and dispensaries in Belgian Congo. While money has been wisely spent not upon elaborate buildings but upon such conveniences as steam disinfestation apparatus, steam cooking and hot water supply to theatres, the general level of cleanliness and nursing does not seem to reach that of Nigeria. Some space is given to the medical services of the large concessionary companies, Huileries Congo Belge, Forminière organizations, Union Minière du Haut Katanga. In 1925 there were 52 medical men attached to these, and 18 to religious organizations. In 1927 the cost of the medical service of the Union Minière was £103,000.

* For Methods of Trypanosomiasis Control see this *Bulletin, ante*, p. 341.

The Forminière organizations have a system of standard dressings and drugs tables which greatly simplifies the training of semi-educated African assistants. At Tshikapa native infirmières examine labourers upon enlistment, one searching gland juice for trypanosomes and another scrutinizing a blood film. An account is given of the labour conditions and ordinances [see this *Bulletin*, Vol. 26, p. 409 and elsewhere].

In Tanganyika boys receive a training of three months or longer in the Health Department to become African sanitary inspectors; others are trained at hospitals as tribal dressers.

Native administration dispensaries.—For Uganda a description is given of the system of country dispensaries under the care of Asiatic and African subordinates in connexion with Mulago hospital. Many patients pay for their medicines, a system which works well except in the case of diseases such as yaws and syphilis, in which the thoroughness of the treatment depends on the wealth of the recipient. Patients who are seriously ill are collected by motor ambulance and taken to Mulago.

Training of medical subordinates.—In this section the work in progress in Belgian Congo, Tanganyika, Uganda and the Sudan is described. Of the Indian sub-assistant surgeons in Tanganyika, Dr. Johnson writes—" Generally speaking they appear to be neither energetic nor reliable. I personally believe that a well-educated and trained African as soon as he is available will make a more satisfactory assistant." He was much struck with the human material and the training in Uganda,and comparing the Makerere College in Uganda with the Gordon College in Khartoum thinks it possible that the Uganda boys with their grit and keenness may prove the better material for medical training.

Infant Welfare and Maternity Work.—It is noted that child welfare work has now become an established branch of medical effort throughout Africa. A description is given of the clinics, maternity hospitals and midwifery training schools seen, but the author writes—Campaigns against malaria, venereal diseases, etc., and research leading to improvement of nutritional deficiencies may have a wider influence upon birth rate and infant mortality rate than local attention to mother and child. Uganda was found to be ahead of the colonies visited in its infant welfare and maternity work, which are missionary activities. Valuable work in the training of Mohammedan girls as midwives is being done in Omdurman in the Sudan.

Medical Laboratories and Research Work.—Here notice is directed to the Union Minière Laboratory at Lubambashi where special attention is given to vaccines and the vaccination of the 20,000 employees of the Company.

A. G. B.

BLACKLOCK (D. B.). **The Prevention of Disorders and Disease in Tropical Countries.**—*Jl. State Med.* 1931. Apr. Vol. 39. No. 4. pp. 204–218.

An admirable paper which should be reprinted for distribution among intelligent laymen. Where the essence of precautions lies in detail, detail is given, e.g., the care of drinking water on the march in Africa. As regards education of doctors Professor Blacklock thinks that the curriculum of the tropical schools is overcrowded. " Our aim should

be that every one should be as far as is possible absolutely sure of the diagnosis and treatment of the common serious tropical diseases, and of the simplest and most effective means of preventing such diseases." Two points to which special attention is drawn are the need for production of quinine in sufficient quantities and at a low enough price to supply the needs of the Empire [the question of the value of the other cinchona alkaloids is not touched] and the need for development of suitable types of properly cooled houses for white men in the tropics. "The householder in this country who has no means of warming his house is no more entitled to complain than the householder in the tropics who has no means of cooling his house."

A. G. B.

BLACKLOCK (D. B.). **Report on a Survey of Human Diseases in the Protectorate of Sierra Leone. Part I—Northern Province.**—44 pp. **Part II—Central and Southern Provinces.**—44 pp. 1930. Freetown.

This Report deals separately with the Northern Province and with the Central and Southern Provinces. The first survey occupied 5½ months and concerned 4,337 persons; the second a year with 5,153 examinations. In the account which follows the two parts are blended. The roughly alphabetical arrangement is preserved.

Ainhum. 24 pronounced cases were seen.

Arthritis. The table shows the findings.

SHOWING JOINTS AFFECTED BY SWELLING OR DEFORMITY, AND BY PAIN ALONE.

Affected Joints.	With Swelling or Deformity.	With Complaint of Pain only.
Clavicular	4	—
Shoulder...	4	10
Elbow	31	5
Wrist	15	6
Hand	34	1
Hip	13	4
Knee	108	41
Ankle	91	6
Foot	73	1
General	—	11
Total	373	85

In the many cases where more than one joint was implicated that most affected is named.

Blood Examination. In 616 blood films no trypanosome was found. In the North the night blood of 259 persons showed *Mfilaria bancrofti* in 38; in the Centre and South this worm was rarer. *Mfilaria loa* was a rare finding and no case of *O. volvulus* was met with.

Agglutination Tests. In a total of 556 persons whose serum was examined for enterica agglutinins there were 61 positive reactions—these in the Centre and South—28 with *Bact. typhosum*, 3 with *paratyphosum* A and 30 with *paratyphosum* B. In the North a few positive tests are recorded and the author says that there is probably no race or area in Sierra Leone which is free.

The Kahn test was carried out in a number of communities ; it varied from 6 per cent. in a girls' school to 86 per cent. among out-patients at Rotifunk ; in a women's hospital it was nearly 60 per cent. The test is largely indicative of yaws infection.

Dermatitis. These cases formed 32–60 per cent. of persons examined on the Northern journeys but were less prevalent in the Centre and South. In 29 cases a pellagra-like eruption was seen on the hands or feet or both. Perleche was noted in the South in 35 cases.

Diseases of Ears. Cases of deafness with or without running ears are tabulated.

Diseases of Eyes. Affection of one or both eyes was noted 420 times. The commonest were—ulcers and opacities of the cornea, pterygium, cataract, blepharitis, ptosis, purulent conjunctivitis, shrunken globe ; the visual power was often gravely affected. One definite and several probable cases of trachoma were seen. Complete blindness in one or both eyes was noted 29 times in the Centre and South.

Elephantiasis. Of 91 cases in 39 the legs were affected and in 47 the scrotum. Here Dr. Blacklock notes the need for local hospitals, for though all in the North who were willing for operation received an introduction to the Freetown hospital, not one reported there.

Ganglia of the wrist was seen in 20 cases : of 15 in which the history was recorded all had yaws.

Gangosa. This condition is discussed at some length and will be considered elsewhere. It was most prevalent in the North, where it is much feared ; 64 cases were there seen.

Gland Enlargement and Scars over Glands. Over 2,000 cases showed one of these conditions. The groups of glands chiefly affected were the inguinal, femoral, and femoral and inguinal, followed by the axillary.

Gonorrhoea. Of 732 males over 14 in the North 44 had acute gonorrhoea and 260 a history of a recent attack. The corresponding figures in the Centre and South were 2,424, 348, and 804—an incidence of nearly 50 per cent. " It is clear that such an incidence with its well-known sequelae of joint involvement, eye infection, and effects upon the female generative apparatus makes it a very important disease in Sierra Leone," but " it is difficult to see how the mass of this disease can be properly treated at any time in the near future," even in males. In many chronic cases an ulcerative process seemed to start on the scrotum : the gonococcus, Blacklock thinks, may be responsible for much skin disease affecting the genital region in the tropics.

Of *Perineal fistula* there were 10 cases with a history of gonorrhoea, of which it is a late effect.

Hernia and Hydrocele. 1,324 cases. The umbilical hernias far outnumbered the other forms, but when umbilical, inguinal, and femoral were arranged in age periods the inguinals outnumbered the umbilical in the 3rd or at least 5th decade. Among males inguinal hernias of large size were common. Of hydrocele some 300 cases were seen.

Leprosy was more common in the North than in the Centre and South, 183 cases against 60. It is suggested that the villages on the motor roads do not encourage the presence of lepers and that these have difficulty at present in reaching the road when warned to come for examination. There is no evidence of any form of native segregation.

Liver Enlargement of unknown origin was noted in 17 males.

Muscular Paralysis. 42 cases are tabulated. Two women had signs of tabes and paresis of one or both eyelids was recorded in 28 cases.

Mycetoma-like conditions. Six cases are described. They cause serious deformity and invaliding and call for investigation.

Phthisis. This disease finds no place in the survey of the Centre and South. In the North no case of lung disease was due to the tubercle bacillus, but cases of long duration were seen with fever, emaciation, rapid pulse and respiration with cough and purulent expectoration.

Schistosomiasis was little encountered in the North. In the Centre and

South 105 examinations of 952 urines were positive. A table is given of the findings in school children. Ten endemic localities are named; in 8 of these *Physopsis globosa* was found and in 5 again dissection revealed cercariae of human schistosomiasis. The conditions at three of the highly infected villages are discussed. Here there is a heavy infection rate among school children and the risk is indicated of transferring scholars from endemic to non-endemic areas where the carrier snail may be present. The schools should be provided with samples of snails and a record of findings kept by the schoolmaster. "From the educational point of view I cannot imagine a more simple or more profitable form of Nature Study for Protectorate school boys than a properly organized and conducted survey for physopsis."

Lesions of Soles were found in 1,339 cases. In some villages the whole male population seemed to have tender feet and could walk only with difficulty. The age and sex incidence is tabulated. There was a history of yaws in 741 of 1,022 males and 286 of 317 females.

Sleeping Sickness. Three cases are mentioned, one doubtful. It is described as insignificant in its effects compared with many other diseases.

Smallpox. No case was seen. It is noted without explanation that the dread of vaccination prevents many natives coming for examination.

Subcutaneous and juxta-articular nodules are grouped; 475 cases were seen. The age and sex incidence are given without attempt to differentiate the forms. The *O. volvulus* nodules are usually near joints.

Congenital Syphilis. Examination of 3,858 persons for Hutchinson's teeth discovered one case, and of 3,595 for sabre tibiae 38. The author points out that the incidence of congenital syphilis depends on which criterion is adopted.

Acquired Syphilis. Under this head is a table showing the age incidence of 334 cases of lesions of the skin of the penis and glans. The majority, 118, occurred in the age period 11–20. Skin infection accounted for most but many were due to injury at circumcision; 10 such cases are tabulated; the ages varied between 3 and 36 years. Many lesions were associated with gonorrhoea, others with a history of yaws; 29 might have been syphilitic. The evidence of primary acquired syphilis on these journeys was almost negligible.

"It appears to me that the acute gonorrhoea-primary chancre ratio in the Protectorate is so abnormal that one must conclude that some factor is at work which either prevents *Sp. pallidum* from causing infection or at least prevents syphilitic sores of the genitals assuming a characteristic form."

Ulcers, Sinuses and Scars.—A record was kept in the North, excluding multiple ulcers associated with gangosa, affection of glands, yaws and leprosy. Of 2,194 persons 708 were affected.

SHOWING INCIDENCE OF ULCERS, SINUSES AND SCARS IN 708 CASES AFFECTED.

Area.	Total Examined.	Ulcers.	Sinuses.	Scars.	Dry Ulcers Soles Feet.
Gbabai to Yonibana ...	622	101	84	68	43
Port Loko to Batkanu, etc.	497	52	24	38	7
Magburaka to Kamabai ...	1,075	140	85	191	30

Yaws. On one journey, of 710 persons 73 per cent. were affected.

AGE AND SEX DISTRIBUTION OF 719 CASES OF YAWS.

Age Period.	Males.	Females.
0–10	285	211
11–20	60	43
21–30	21	57
31–40	12	12
41–50	12	6
Totals	390	329

The table shows well the age incidence. Another tables gives the site of the primary lesion ; it is commonest on the foot ; next on the knee and finger. 54 per cent. of the total population examined were or had been affected. The treatment of this disease, the author writes, should be extended.

The 2nd Report concludes with a review of the present position at Kaiyima [see this *Bulletin*, Vol. 22, pp. 463 & 652 ; Vol. 24, p. 514]. In 1923–4 the villagers were strongly affected with goitre and schistosomias, the first largely attributed to bad sanitation, the second due to Physopsis which flourishes under such conditions. The goitre figures were for males 41 per cent., for females 72 per cent., and the schistosomiasis figure was 65 per cent. The measures taken were—provision of a pure drinking water supply, of a safe method of disposal of excreta and village refuse away from water, and of snail-free bathing and washing places, with treatment of polluted waters and effective control.

In September 1929 the villagers were re-examined. The goitre per centage had fallen from 41 to 23 per cent. in males and from 72 to 52 in females, and many of the goitres were slight. The percentage of schistosome ova in boys had fallen from 65 to 42 per cent. and the infections were much less severe. The medical officer is now to be removed from Kaiyima, but it is suggested that for the encouragement of the Paramount Chief, who has done good work, a dispensary should be maintained for one or two years longer.

A table gives the percentages of various diseases in the Northern and Central and Southern provinces respectively.

" It will be observed that there is a similarity in the percentage incidence of the following :—

" Arthritis, diseases of the eyes, hernia, and the typhoid group ; that the incidence of the following diseases is less in the Central and Southern Provinces :—Dermatitis, elephantiasis, gangosa, gland affections, goitre, leprosy, subcutaneous and juxta-articular nodules and yaws (Framboesia) ; while the incidence of gonorrhoea and schistosomiasis is higher in the Central and Southern figures than in the Northern."

It is stated that the Southerners are better fed and wear more clothes, which may account for the lower figures of diseases dependent on insect transmission and infection through skin abrasions.

The author discusses the diseases described from various points of view. To the native the most serious are cutnose (gangosa), arthritis, leprosy and in endemic areas bigneck (goitre) ; to the clinician the order of importance is malaria, gonorrhoea, yaws ; to the research worker probably parasitic skin disease, goundou and ainhum. He points out that the malaria problem is one of educating the African in elementary sanitation, and such education should be supplied as widely as possible. He would defer an attempt to deal with leprosy till further investigation has been made in other provinces. More surgical assistance should be available for the natives of the Northern Province.

A. G. B.

BOYÉ. L'emploi de la main-d'oeuvre chinoise au Congo Français. [**The Employment of Chinese Labour in French Congo.**]—*Bull. Office Internat. d' Hyg. Publique.* 1931. Jan. Vol. 23. No. 1. pp. 78–91. [2 refs.]

In the construction of the railway from Brazzaville, at the limit of the navigable Congo, to Pointe-Noire on the Atlantic Ocean it was necessary to supplement the scanty local labour, and though the precedents were not encouraging the authorities turned to the Chinese. Previous attempts to introduce Chinese labour into Tropical Africa had ended disastrously, in the French Sudan in 1882, in Madagascar, and in Belgian Congo 10 years later, but the immense progress made since then in the hygiene of groups of natives justified a fresh trial.

The mortality in previous attempts.—Of the 35 Chinese introduced into French Sudan in 1882 records are few, but all seem to have disappeared. In 1892 529 Chinese coolies were embarked at Macao for Matadi, Belgian Congo, for railway construction. The losses on the voyage are not known. Less than 4 months after their arrival there remained 300, a loss of 43 per cent., and 26 months after their arrival only 170, who were repatriated. The total loss was 68 per cent. The most deadly diseases were, malaria, dysentery, beriberi and phagedenic ulcers, usually the sequel of jigger wounds. The ration consisted of imported polished rice 500 gm., or manioc 750, dried fish 250 gm. or bananas 1 kg., and salt 10 gm., and little to supplement it was obtainable in the native market. The losses in Europeans were likewise heavy, so that it is said to this day of the Matadi-Leopoldville railway : For every kilometre a European, for every sleeper a native. Similar losses occurred among 20 Annamites brought to French Congo as market gardeners about the same time but one of these is still alive at Brazzaville. Among 600 Chinese brought to Madagascar in 1896 and 1897 the losses again were great and after a year the remainder were repatriated. A writer of the period, after calling attention to the aversion of these Asiatics for sustained physical effort, attributed the failure largely to the jigger flea.

Chinese labour in French Congo, 1929–30.—In 1929 the men to be recruited were carefully examined in China. They were vaccinated against enteric and cholera, against plague and against smallpox. They were loused. To clear them of intestinal parasites they received on 3 successive days 2 gm. thymol (this was incomplete in many instances). Each received a medical card recording vaccinations and initial weight, on which the medical history would be kept. Lastly, before embarkation a final visit was paid to eliminate any acute disease. On board ship the diet was a congenial one with the usual Chinese condiments. The rice was red, not polished. To guard against chill off the Cape of Good Hope each man was provided with woollen clothing and supplementary blankets were available. The coolies were accompanied by a European and a Chinese doctor, from the Hanoi school of medicine, who was to remain in the Congo.

The Government of Equatorial Africa received detailed instructions for the reception and maintenance of the coolies. Regular consignments of food were received from the country of origin, notably tea. All these matters were supervised by Dr. LASNET, both in Indo-China and in Africa.

782 coolies were embarked at Kuang-Chau-Wan and disembarked two months later in the Congo. They were taken to camps prepared

for them. The ration was calculated to furnish 3,000 calories a day for a man of 50–60 kilos weight working 9 hours. It was as follows—

	Dry rice	700 gm.
or	Bread	250 ,,
	and	
	Dry rice	500 ,,
	Fresh or salted meat	200 ,,
or	Dried or salted fish	200 ,,
or	Fresh fish	400 ,,
	Green vegetables	300 ,,
or	Dried ,,	150 ,,
	Salt	20 ,,
	Tea	5 ,,
	Fat	20 ,,

The dried vegetables and preserved meat were to be distributed only when fresh food was absolutely unobtainable. The local administration had to import cattle and pigs, and at times to fall back on game animals. An industrial product known as pâte azotée (a preparation of fish) was employed with success in convalescents and the ailing. Fruits and vegetables were grown on the spot.

Details of the care of the coolies in Africa follow. They were trained for the work they had to perform and were suitably protected against the weather. Hats with broad brims were brought from China. The morning meal was taken in the camp. The hours of work were limited and a rest taken at midday. Good water or tea was provided at all hours.

A daily dose of 0·5 gm. quinine was given under the surveillance of a European. Controls by the use of Tanret's reaction with appropriate punishments for failure to swallow the dose were at first used but became unnecessary. Mosquito nets were employed but not by all. Thanks to the precautions taken malaria was rare; there were only 8 deaths, 2 of them from blackwater [no information of the malarial index of the surrounding natives]. Against dysentery, vaccination by anatoxin according to Ramon's technique was general. The fear of beriberi was always before the authorities. Several cases were reported but only 10 deaths. It was met by the prompt substitution of wheaten bread for rice in the gang affected; and the addition to the diet of ground nuts, fruits, green vegetables and pâte azotée. To protect them against jiggers boots were furnished and against wounds of the legs puttees. These measures were also protective against hookworm. No cases of sleeping sickness occurred; efforts to eliminate it from the region concerned were made before the coolies came.

There were 30 deaths [? 31] (beriberi 10, malaria 6, blackwater 2, dysentery 3, pneumonia 2, other causes (not endemic) 8); a percentage of 4 in 15 months; and in the last 3 months only one death. [This percentage is not strictly correct, for 172 Chinese were deported as undesirables after 5 months.] The health of the Chinese coolies, with the exception of one month, was better than that of the African natives who worked alongside them.

The experiment has proved [for the layman's benefit] that by the strict application of the laws of health and of the prophylactic measures that increased knowledge of tropical medicine has brought us, Asiatic labour may be safely employed in Tropical Africa.

A. G. B.

PROCTER (R. A. W.). **The Health of Labour on the Kisumu-Yala Railway Construction.**—*Kenya & East African Med. Jl.* 1931. Jan. Vol. 7. No. 10. pp. 276–281. [1 ref.]

The author describes briefly the siting of the camps, clearings, latrines, in which there was no nuisance so long as a sweeper could be obtained, huts, ration, etc. Special measures were applied for malaria but the expense was considered hardly justified. Hospital requirements were estimated at 60 beds; throughout the year approximately 2,200 boys were employed each month and there was an average of 11 admissions to hospital per month, so that the provision was too ample. The 131 admissions were headed by malaria, local injuries, ulcers, pneumonia; dysentery and typhoid accounted for two each. The low sick rate was attributed mainly to the fact that all the labour until the last 3 months was drawn from the neighbouring Reserve, and that 1929 was a healthy year [a consideration which often fails to be stated]. It is also noted that the camps were well sited, and the diet was adequate. The diet scale was as follows—

Maize meal	11 lbs. weekly.
Chiroko or other pulses	1½ lbs. weekly.
(or fresh meat 1 lb.)	
(or dried meat ½ lb.)	
Fresh meat	1 lb. weekly.
(or dried meat ½ lb. weekly)	
Ground nuts	1 lb. weekly.
(or ghee or fat ¼ lb. weekly)	
Fresh vegetables	1 lb. weekly.
(or potatoes 2 lbs.)	
(or lemons 2)	
(or oranges 2)	
(or limes 6)	
Salt	¼ lb. weekly.

Cooking pots and fuel supplied by contractor.
One cook to twenty boys.

The net cost for medical services was £1,550, equivalent to less than 15 shillings per boy per annum.

A. G. B.

BRUXELLES-MÉDICAL. 1931. Jan. 11. Vol. 11. No. 11. pp. ccclxxii-ccclxxiv, ccclxxvi-ccclxxviii.—Sur le recrutement des médecins pour la Colonie. [**The Recruitment of Doctors for Belgian Congo.**]

The Editorial Committee of the *Bruxelles-Médical* organized a conference for an exchange of views on this subject. A questionary drawn up previously is given. It seeks information on such topics as the reasons why doctors on leaving the universities do not embrace a Colonial career, the sufficiency of the salaries, the scarcity of military doctors in the Colony, methods of propaganda for recruitment, the creation of courses of tropical medicine at the universities, the engagement of women doctors, the eligibility of doctors for high posts in the administration. A consensus of opinion was to the effect that morbidity in the tropics and insecurity of career as compared with Belgium were the chief causes of the reluctance to embark on colonial medical life. To combat these objections, regarded as exaggerated, propaganda must be carried into the bosom of the families concerned. Salaries

at least are much better than in French Africa. It is suggested that official positions in Belgium should be assured by law for the doctors returned from Africa, and they should be insured when they first enter the Colony against sickness and accident. It is pointed out, however, that the causes of the scarcity of doctors lie deeper: France meets with great difficulties and even Holland and England do not find the position easy.

"On pourrait se demander s'il n'y a pas, de par le monde, une sorte de *défaitisme colonial*, défaitisme fréquemment encouragé par les doctrines de Moscou répandues un peu partout, bruyamment encouragées aux extrêmes gauches, mais occultement et souvent inconsciemment suivies dans beaucoup de milieux bourgeois, et cela dans tous les pays."

It is suggested that the colonial mind is wanting in Belgium. The absence of enthusiasm is shown by the paucity of military doctors in the Colony. Suggestions for the improvement of the position are made.

A. G. B.

MOELLER (J.). Rapport concernant son séjour à l'hôpital de Kisantu de septembre 1929 à mars 1930. [**Visit to the Kisantu Hospital (Belgian Congo).**]—*Ann. Soc. Belge de Méd. Trop.* 1930. Sept. 30. Vol. 10. No. 3. pp. 311–324.

In 1926 the University of Louvain decided to found in Belgian Congo a medical institute where Colonial doctors would supplement the instruction they had received in Belgium, native *infirmiers* and medical assistants would be trained and research carried out on animal and vegetal tropical pathology. This is designated Fomulac (Foundation Médicale de l'Université de Louvain au Congo). At the end of three year the enterprise had thriven so well that there had been built a native hospital, clinic for Europeans, research institute, school for infirmiers, the whole in eight blocks, electrically lit and supplied with running water.

Here the author spent about six months and he discusses in his article the treatment of pneumonia by salicylate of soda, tropical ulcer and the organization of a sleeping sickness campaign. The salicylate of soda was given by mouth 4 to 6 grams a day for 6–8 days, he believed with good effect, in 17 cases. It does not replace but is additional to the usual treatment. In grave cases it may be given by the veins (3 grams a day in a 1/30 solution). A careful investigation of the 4 chieferies of the district with its 10,000 inhabitants was made for sleeping sickness. Over 10,000 natives were seen and in over 1,000 a gland was punctured but only 4 cases were discovered. Sleeping sickness has been combated here for 20 years by the Kisantu missionaries and is evidently under good control. The population is growing.

A. G. B.

VAN NITSEN (R.). Diagnostic et traitement des affections intestinales chez les travailleurs industriels du Katanga. [**Diagnosis and Treatment of Intestinal Affections in Industrial Workers of the Katanga.**]—*Bull. Méd. du Katanga.* 1930. Vol. 7. No. 4. pp. 93–107.

A didactic clinical paper which cannot be summarized. The table is of interest as showing the difference in parasitic infestations in natives from different districts.

	Rhodesians.	Congo (principally Lomami).	Ruanda-Urundi.
Number of examinations	2,453	1,765	5,641
Ankylostomes	898 or 36·61%	538 or 30·48%	481 or 8·53%
Trichocephalus	43 or 1·75%	61 or 3·45%	1,711 or 30·33%
Ascaris ...	136 or 7·17%	54 or 3·06%	586 or 10·39%
Taenia ...	49 or 1·99%	24 or 1·36%	451 or 7·99%
Strongyloides ...	121 or 4·93%	115 or 6·51%	205 or 3·63%
Bilharzia ...	80 or 3·26%	228 or 12·92%	44 or 0·78%
Amoebae ...	3 or 0·12%	3 or 0·12%	134 or 2·37%
Trichomonas, Giardia and Balantidium	179 or 7·30%	69 or 3·91%	327 or 5·79%

A. G. B.

GASCA (A.). Rapport sur la croisière médicale du bateau hôpital "Belgique" de Berghe-Sainte-Marie à Kabinda. [**Cruise of a Hospital Ship on the Congo.**]—*Ann. Soc. Belge de Méd. Trop.* 1930. Sept. 30. Vol. 10. No. 3. pp. 285–310.

This article consists of a series of notes on sleeping sickness and other diseases seen on the left bank of the Congo between the mouths of the Kasai and Ubangui rivers in the course of a 2–3 months' cruise. The author reports on 65 villages in which 5,717 natives were examined for trypanosome infection, or with others examined previously by Dr. STANFORD, 8,664. A total of 95 fresh infections was found, i.e. 1·09 per cent., and, including old cases, 417, i.e. 4·8 per cent. All were treated and arrangements were made for their future treatment at neighbouring stations; 790 glands were punctured. Yaws was commonly found, and 17 cases of leprosy were recognized.

A. G. B.

SCHWETZ (J.). Deux voyages d'études médicales et paramédicales dans le Bas-Lomami. [**Two Medical Tours on the Lower Lomami River.**]—*Ann. Soc. Belge de Méd. Trop.* 1930. Dec. 31. Vol. 10. No. 4. pp. 385–403. With 1 map. [4 refs.]

Much of this is of purely local interest. The Lower Lomami, which runs north to join the Congo at Isangi, is reckoned to start from Obenge Benge at nearly 2° S., a stretch of 250 km. as the crow flies. The author visited this area with a small steamer in June and July 1928, and again in October-November the following year. Here the tsetse which AUSTEN has described as *G. newsteadi* was found. *G. palpalis* is present everywhere, increasing in numbers as the river is ascended, and on all the tributaries explored. The crepuscular forms, *G. fusca* and *G. tabaniformis*, were also found. On the voyage down 15,644 natives were examined in 50 villages. Nine old cases of sleeping sickness were detected and 6 fresh cases; the author thinks the real number would be double. No cases were found above Loya, which is situate halfway along this stretch of river, though *palpalis* goes all the way. As to other diseases, the author merely lined up the natives

and made an external examination. Yaws and ulcers are very common; 56 cases of leprosy were diagnosed, 40 in men and 16 in women. Of the forms of itch, filarial itch (*O. volvulus*) was common. The natives call the thickened skin "ngosi ya tembo"=elephant's skin. All have subcutaneous nodules, chiefly on the ribs; these contain adult Onchocerca. Below Opala the disease is very rare though the carrier, *Simulium damnosum*, abounds below as it does above. Whereas the other tribes inhabit separate huts, the affected tribespeople live in long barracks with a common verandah, which probably facilitates contagion. Juxta-articular nodules also are general, chiefly in male adults. They are found (in that order) on hips, elbows and knees, ankles, shoulders, vertebral column and, rarely, on the ribs. Association with yaws is here comprehensible, but why are these nodules absent in other places where yaws is common? As a rule these nodules can be distinguished from those of Onchocerca: if not, puncture or excision will settle the matter. Twenty species of mosquito are listed, bred from larvae collected, and 11 species of adult mosquito, 4 of which are not represented in the first list.

A. G. B.

BOUFFARD. L'assistance médicale et l'hygiène publique en Côte d'Ivoire. [**Medical Assistance and Public Health in the Ivory Coast.**]—*Ann. de Méd. et de Pharm. Colon.* 1930. Oct.-Nov.-Dec. Vol. 28. No. 4. pp. 513–556.

This article, which is evidently intended partly for the layman, deals with the general organization of the health service in the Ivory Coast, the hospitals of various grades, child welfare centres; with the medical personnel of the Colony, midwives, medical assistants; with sanitation of houses and villages, labour agglomerations, public works, and with a few of the endemic diseases.

A. G. B.

KLEINE (F. K.). Erfahrungen einer ärztlichen Studienreise nach Ostafrika. [**Medical Experiences on a Visit to East Africa.**]—*Deut. Med. Woch.* 1931. Jan. 23 & 30. Vol. 57. Nos. 4 & 5. pp. 153–155; 194–196. [17 refs.] [Robert Koch Inst., Berlin.]

About half this account of Professor Kleine's experiences relates to trypanosomiasis and is considered elsewhere. Seeing that bugs are common in African huts and that bugs are proved to be occasional transmitters of spirochaetes, the author fed a dozen *Ornithodorus moubata* on 2 white rats and when the rats' blood swarmed with spirochates put them in a bug-infested box to which the bugs were strictly confined. Four days later he removed the sick rats and every few days for 6 weeks put in fresh ones. None became infected, though the experiments were 4 times repeated. Nor did clean rats become infected even when confined for a week with sick rats. In the gut smears of 25 bugs examined after 4 days' feeding on infected rats a few spirochaetes were found, but none in 77 bugs (gut or organs) killed from 4 to 40 days later.

The author discusses his experiences with diphtheria and scarlet fever tests in native children [see this *Bulletin*, Vol. 27, p. 558]; he thinks that an explanation of his results—all negative for Schick, all positive to Schultz-Charlton reaction—is yet to seek.

Professor Kleine's tuberculosis experiences have been recently noticed

[*ante*, p. 30]. They concern only a small number but lead him to the belief that tuberculosis usually runs a benign course if the natives are well fed and remain quietly at home and that there is no fear of an epidemic outbreak of tuberculosis in Central Africa.

He saw two cases of paralysis after probable polyomyelitis and Dr. ATIMAN described to him cases, of which he had seen 17, with 10 deaths, which were at first taken for chronic sleeping sickness but which Kleine believes to be epidemic encephalitis. Kleine himself saw 3 such cases.

East Coast fever, rinderpest and horse sickness are also discussed.

A. G. B.

ORENSTEIN (A. J.). **The Clinical Significance of Certain Common Parasites of Man in South Africa, with Outlines of Treatment.**—*Jl. Med. Assoc. South Africa.* 1930. Aug. 9. Vol. 4. No. 15. pp. 447–452.

The parasites, or rather the infections caused by them, are amoebiasis, trichomoniasis, hookworm infestation, schistosomiasis and malaria. The author gives full details of his methods of treatment, especially in malaria. His experience makes these of considerable interest but limits of space prevent their description here. He notes that amoebic dysentery of the acute type met with in the tropics is seldom seen in the Union. The symptoms are frequently vague. He is of those who think that trichomonas infection causes symptoms which clear up when the flagellates disappear. He gives medicinal methylene blue by mouth, 2 to 3 grains every two hours till the sclera and urine are blue. The patient is put, as far as possible, on a pure protein diet. The treatment is usually effective.

A. G. B.

i. THORNTON (E. N.). **A Medical and Nursing Service for Natives in South Africa.**—*Jl. Med. Assoc. South Africa.* 1930. Sept. 13. Vol. 4. No. 17. pp. 507–511.

ii. MCCORD (J. B.). **A Native Medical Service in South Africa.**—*Ibid.* pp. 511–514.

iii. LORAM (C. T.). **The Training of Natives in Medicine and Public Health.**—*Ibid.* pp. 515–517.

iv. ROSS (G. A. Park). **A Medical and Nursing Service for Natives in South Africa.**—*Ibid.* pp. 519–522.

v. **Discussion on Native Medical Service.**—*Ibid.* pp. 519–522.

The report of the Committee appointed by the Union Government to inquire into the training of natives in medicine and public health was recently noticed in this *Bulletin* (Vol. 27, p. 40). This subject, or that part of it which relates to medical services in rural areas, was put down for consideration at the Annual Meeting of the South African Medical Association held at Durban, and we have here the four papers which were contributed and the discussion. The Committee recommended the institution of a Government Native Medical Service comprising medical practitioners, nurses, and health assistants all of whom would be full-time Government servants. The units would consist of a native medical officer with hospital and one or more health assistants, with two or more nursing stations each

under the charge of a native resident nurse-midwife. The native doctors would have the same training as the European and it should take place in Africa.

i. Sir E. N. Thornton, Assistant Health Officer for the Union, agreed on the really urgent need for natives having reasonable facilities for the preservation of health and adequate medical, surgical and nursing assistance when ill. He notes that in Natal some 1,250 native herbalists are licensed by the State at £3 per head per annum. He criticizes the Committee's scheme in detail, describing it as somewhat grandiose, and thinks they have under-estimated the necessary expenditure. He suggests that the creation of a number of subsidized native practitioners would add enormously to the difficulties of European doctors, for sooner or later the natives would tend to set up practice in the towns. In his view the problem is to give reasonable medical aid to the many as quickly as possible rather than the best in the future to the few, and he considers that the proposal to train native doctors should be rejected. He would use the district surgeon, who is already there, to supervise the work of health centres. In some districts he might become a whole-time medical officer. The natives should be trained, not as doctors, but on the lines of the Auxiliary medical officers in French West Africa. The native medicine men would be gradually replaced by the health centres. The Health Assistants could be trained at Durban under missionary auspices. The cost of the author's plan would be one-third of that of the Committee.

ii. Dr. McCord, of the American Board of Missions in Durban, compared the schemes put forward by the Committee and by Sir E. Thornton. He thinks that the cost of running a health centre will be much less than is anticipated. The Zulu expects to pay for treatment, indeed "doesn't want treatment that he doesn't pay for." In the Mission Nursing Home on the Berea (Basutoland) patients' fees pay 75 per cent. of the expenses of the institution. He thinks that a grant of £500 for each health centre would be enough. He questions the policy of putting the district surgeon in charge, and thinks that the health unit should be a full-time job. He urges the medical profession in South Africa to come to an agreement on what they want.

iii. Dr. C. T. Loram, who was Chairman of the Committee whose Report is under discussion, gives an account of the salient points of the Committee's recommendations and deals with some of Sir E. Thornton's objections. The non-recurrent cost of buildings and equipment for the training of natives in medicine and public health was estimated at £65,000 and this sum will be furnished by the Rockefeller Foundation, provided that Government finds the running expenses.

iv. Dr. Park Ross points out that the ideas of the native are rapidly changing in favour of European methods and instances their behaviour in an epidemic of malaria in Natal and Zululand in 1929 in which there were 3,000 deaths. After discussion with the chiefs 19 natives were given two weeks' training in the rough clinical recognition of malaria, in the taking of temperature and blood-slides and estimation of haemoglobin, in recognition of anopheles larvae and use of oil and Paris green, and also in their capacity of lecturing and dealing with hecklers. The pupils must be young and well educated and have a good knowledge of English. The result was excellent and only one contracted malaria. He has had requests from chiefs for the return

of these men for the next season. He agrees with McCord that the native should pay for the service he gets, and is averse to the State financing the training of native doctors.

v. The discussion on these papers was rambling and seemed to show much diversity of opinion. Resolutions were passed that no distinctions on ground of colour should be made in the qualifications of medical men, nurses and health visitors, and that the Federal Council be requested to formulate proposals for a rural medical, nursing and health service for submission to the Government on behalf of the Association.

A. G. B.

i. HYND (David). **A "Medical Unit" in a Rural Area.**—*Jl. Med. Assoc. South Africa.* 1931. Mar. 14. Vol. 5. No. 5. p. 141.

ii. JOURNAL OF THE MEDICAL ASSOCIATION OF SOUTH AFRICA. 1931. Mar. 14. Vol. 5. No. 5. pp. 148–149. **A Native Location Medical Service. Proposals to establish a Service of Native Location Medical Officers. Submitted for Discussion to the Natal Medical Council by Dr. Campbell Watt, in Connection with a Resolution from the Durban Medical Society.**

i. The medical unit in question has been established by the Nazarene Mission in Swaziland, and consists of a central hospital and medical outposts, with two qualified doctors in charge and three fully trained nurses. The author holds that the profession should "give the weight of its influence in South Africa to the admission of all suitable students to our medical schools irrespective of colour." Male native medical assistants are being trained in a similar way to the native female nurses. The scheme is in its infancy; there are no details of cost.

ii. A summary of the scheme is given. The training of native doctors at Government cost is recommended, as a charge against the Native Affairs Vote.

A. G. B.

JOURNAL OF THE MEDICAL ASSOCIATION OF SOUTH AFRICA. 1931. Jan. 24. Vol. 5. No. 2. pp. 35–46.—**Medical Services in Native Areas. Some Instructive Views and Opinions. (i) A Medical Service for Natives in South Africa** [GOOL (A. H.) pp. 35–37; MAHLANGENI, p. 37; SOGA (A. R. B.) p. 38]. **(ii) The Training of Natives in Medicine. Notes on a Native Medical Service in Rural Areas** [XUMA (A. B.) pp. 39–43]. **Medical Services to the Natives** [WELSH (Robert H.) pp. 44–46].

The Editor of the *Journal of the Medical Association of South Africa* addressed a letter to all native colleagues in the Union seeking their views as to the establishment of a special training school for native medical students, giving an inferior degree; the admission of such students to the preliminary studies at the Universities; their subsequent training in special native hospitals or abroad. Some of the replies are published in this number and will repay perusal.

A. G. B.

ONORATO (R.). Lo stato attuale delle nostre conoscenze sulla nosografia tripolitana. [**The Present State of Knowledge of Disease in Tripolitania.**]—*Arch. Ital. Sci. Med. Colon.* 1931. Mar. 1. Vol. 12. No. 3. pp. 137–186. With 9 diagrams. English summary (7 lines).

The information presented in this article covers so extensive a field and is already so condensed that abstraction is difficult. The author deals not only with tropical conditions but also with infective diseases, medical and surgical affections generally, and vital statistics.

General mortality has varied little during the last 10 years, and the average from 1912 to 1929 has been 35·31 per mille, that among Europeans being 18·47, among the natives 41·06. Infant mortality for the same period is given as 17·58 per mille, Europeans 6·78, natives 20·51.

Respiratory diseases, notably tuberculosis, pneumonia and bronchitis, account for 23 per cent. of the general death rate and are rife in the late autumn and winter. Venereal disease is common, mainly gonorrhoea and syphilis in the muco-cutaneous forms. Other skin affections are mycetomas, particularly nocardia and cohnistreptothrix infections. Ocular diseases, conjunctivitis and trachoma, are widespread, but are said to be diminishing. Of the infections, *tuberculosis* heads the list, the average total mortality in the years 1912-26 being given as 205·8; influenza follows with 75·1, enteric fever 43·1, measles 33·9 and malaria 29·8. The cause of the high figure for enteric is not known, but general sanitation is of a low standard and flies are a pest; the water supply has not been incriminated. *Smallpox* was a scourge in early days of Italian occupation, but as a result of vaccination on a large scale, has been practically eradicated; sporadic cases, about 17 annually, have occurred during the last 18 years with the exception of 1921 when there were 113 reported. *Malaria*, owing to measures of sanitation, bonification, and the widespread use of quinine, is no longer of great moment; the average death rate, 1912–25, was 0·55 per mille inhabitants, 0·08 Europeans, 0·69 natives. Tertian [? benign] is the common type, and the vector is *A. maculipennis*. *Plague* has occurred in small epidemics; in 1913 there were 82 cases, in 1917 43 cases, all bubonic; there have been none during 1926–29 inclusive. *Leprosy* is more common in Cyrenaica, rare in Tripolitania, only 14 cases having been reported in 1912–29. Louse-borne *relapsing fever* occurs, but is not common. Few cases of amoebiasis are reported, and helminthic infestations by Paragonimus, *Schistosoma haematobium*, Diphyllobothrium and hydatid are met with but are rare. Cutaneous leishmaniasis is also seen and very rarely kala azar.

H. H. S.

GARCIA DE OBESO (Lope). Contribución al estudio de la patologia rifena. [**Disease in the Rif Country.**]—*Medicina Países Cálidos.* Madrid. 1930. May. Vol. 3. No. 3. pp. 200–231. With 20 text figs. & 2 maps. [51 refs.]

The district considered is known as the Guelaia territory, a tongue of land directed towards Spain.

Syphilis is very rife; different areas return from 70 to 88 per cent. of the population as affected. Much of it is cutaneous and this is held to account for the rarity of neurosyphilis. The disease is severe and inadequately treated, hence many instances of repulsive facial mutilations due to tertiary lesions are met with.

In Guelaia some 6 per cent. of the inhabitants were found to be tuberculous. On the littoral osseous lesions were commonest, pulmonary coming next; in Fez more than half were pulmonary, nearly a third were glandular and less than 10 per cent. were osseous.

Malaria is infrequent, only 81 patients being treated, and among the total reporting sick about 4 per cent. were cases of malaria. Nearly all were *P. vivax* infections; subtertian was very rare.

H. H. S.

CHAMBERLAIN (Weston P.). **The Health Department of the Panama Canal.**—*New England Jl. of Med.* 1930. Oct. 2. Vol. 203. No. 14. pp. 669–680. With 7 figs. & 2 charts in text.

This, if an oft-told tale, bears repetition. It is that of a colonizing experiment carried out in a region formerly notoriously unhealthy and "is a strong link in the growing chain of evidence . . . that the white race can thrive in many parts of the torrid zone provided the individual is given the protection which modern science is able to afford." In the French attempt to build the canal it is estimated that between 1881 and 1889 at least 16,000 employees died from all causes and this in a force which averaged only a little over 10,000. In 1904 the Americans took over, fortified by a treaty providing for unrestricted sanitary control by the United States, a strip of territory extending 5 miles on each side of the canal, including the cities of Colon and Panama. Between those years—1889 and 1904—two fundamental discoveries had been made, viz., the mosquito transmission of malaria and of yellow fever.

"Armed with the magic wand of mosquito control, assisted by an improved conception regarding the prevention of intestinal infections, endowed by treaty with absolute sanitary jurisdiction over a wide area, and provided with almost unlimited funds, the authorities of the United States in the year 1904 were in a position to cope effectively with the disease situation on the Isthmus, a situation which had hitherto defied control."

The health department was at first under the Governor, but in 1906 was made independent under the Isthmian Canal Commission when GORGAS was appointed a Commissioner. In 1914 the department came under the direction of a Chief Health Officer who reported directly to the Governor, and this post was held by Colonel Chamberlain from 1924 to 1929. The paper contains numerous details of the department's activities to some of which reference is here made.

Malaria prevention has been and continues to be one of the largest problems. No attempt, however, has ever been made to free the Canal Zone from malaria. Efforts are confined to the vicinity of the more important towns within which nearly all the employee population is concentrated. Native farmers are required to live at least one mile beyond the borders of the sanitated towns. The methods have varied. Jungle clearing, screening, mosquito killing, larvicides, prophylactic quinine have given place to final obliteration of mosquito-breeding areas by means of permanent drainage. Fuel oil is still used for bodies of water which cannot be obliterated, and stress is laid on treatment of malaria cases in hospital and prolonged after-treatment. The danger of shade removal is well recognized. Drainage systems now extend from one to three miles beyond the borders of the towns. Anopheles are rarely found within the sanitated areas; in Colon and Panama window screens are unusual. Details are given of the methods

of drainage. In the period 1926–28, 110,000 dollars per year was spent on antimalarial work, largely permanent or semi-permanent drainage. In the period 1921 to 1929 there were only 3 deaths from malaria in a force averaging 13,000 persons. The reduction of mortality in Colon and Panama with crowded negro population is striking. In Colon in 1906 the death rate was 51 ; it is now 12–14. Tropical disease figures little in the causes of death, which are headed by tuberculosis and pneumonia.

A. G. B.

CHTCHERBAKOFF (S. G.). Les maladies tropicales à Kachgar (Chine ouest). [**Tropical Diseases at Kashgar (Western China).**]—*Rev. Méd. et Hyg. Trop.* 1930. Sept.-Oct. Vol. 22. No. 5. pp. 233–256.

The area in question is part of Chinese Turkestan ; it borders the U.S.S.R. on the west, Kashmir and Tibet on the south and south-east. The climate is continental with hot summers and cold winters ; the air is extremely dry and rain is deficient : the altitude is over 4,000 feet. After 18 months residence the author had identified malaria, pappataci fever, dengue, sprue, beriberi, goundou, oriental sore and kala azar (in natives of India). He discusses his observations of each. Pappataci fever was diagnosed in 50 cases, all between May and September ; phlebotomus was seen from the end of June to the end of July. All were cases of fever of short duration with absence of plasmodia from the blood. Five had a short relapse. Dengue was diagnosed in 23 instances between June and September but no mention is made of the mosquitoes which convey it. Two cases are described as sprue. Goundou was diagnosed in thirteen cases, some of which are described : in the majority the swelling was slight. Two cases of oriental sore with demonstration of leishmania are described ; of malaria 193 cases were seen, 171 tertian, 17 subtertian and 5 quartan. Only one species of anopheles was found, *A. saccharovi*, and this is described as domestic. Fever and symptoms appear to have been slight. Of beriberi 11 cases were seen.

A. G. B.

MOUILLAC. Notes sur l'épidémiologie, l'endémiologie, la géographie, la climatologie et l'hygiène à Yunnanfou (Yunnan). [**Epidemiology, Endemiology, Geography, Climatology and Hygiene at Yunnanfu.**]—*Ann. de Méd. et de Pharm. Colon.* 1930. July-Aug.-Sept. Vol. 29. No. 3. pp. 329–361.

This article deals shortly with the diseases met with at the capital of the province of Yunnan, China, and at interesting length with those habits of the Chinese in which hygiene should play a part. [For the diseases of this region see WATSON, this *Bulletin*, Vol. 25, p. 368.]

A. G. B.

ROSKOTT (E. R. A. Luyke). De medische verzorging van het eiland Billiton. **Medical Organization on the Island Billiton.**—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1930. Nov. 1. Vol. 70. No. 11. pp. 1132–1143. With 9 figs. on 5 plates.

The island Billiton in the D.E.I. archipelago has 70,760 inhabitants, of whom about 30,000 (chiefly Europeans and Chinese) find occupation

in the tin mining industry. The mining company has taken up the sanitary organization of the whole island. The author gives a description of this organization, working with 5 physicians, partly in two central hospitals and partly employed for sanitary and clinical work. The growth of this work since 1852 is briefly sketched and a description of the central hospitals and of the (partly ambulatory) clinics is given.

W. J. Bais.

STRAUB (M.). Opmerkingen omtrent Immigratie en Sterfte bij de Deli Maatschappij en de "Poenale sanctie." [**Remarks on Immigration and Mortality in the Deli Company and the "Penal Sanction."**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1930. Nov. 1. Vol. 70. No. 11. pp. 1069–1075.

The sanitary development of the East Coast of Sumatra is without doubt chiefly due to the strict hygienic supervision of the native labour forces, possible only under the regulations of the "cooly contract." Yet on a number of estates a free labour force already exists besides the indentured one.

By comparison of these population groups of the estates of the "Deli Maatschappij" the author shows :—

(1) that the mortality of the indentured labour force of the rubber estates compares favourably with that of a similar population in Europe,

(2) that on the tobacco estates the mortality in this group is about 35 per cent. higher than in Europe,

(3) that in the free labour force and their families the mortality is 75–135 per cent. higher than in Europe.

This is a strong argument in favour of the indenturing of native labour as an hygienic weapon. Yet only a part of the population draws the full benefit of it and on the other hand the patriarchal conditions of indentured labour are politically doomed to disappear. The author pleads for an altered attitude of the medical profession towards the native population, seeking *contact* instead of *contract.*

W. J. Bais.

KOUWENAAR (W.). Policlinieken voer arbeiderskinderen ter Oostkust van Sumatra. [**Clinics for Children of Coolies on the Plantations of Sumatra's East Coast.**]—*Nederl. Tijdschr. v. Geneesk.* 1930. Mar. 29. 74th Year. 1st Half. No. 13. pp. 1654–1656. [2 refs.] [Summary taken from *Social Sci. Abstracts.* 1931. Jan. Vol. 3. No. 1. p. 160. Signed J. J. van Loghem.]

Kouwenaar describes the measures which the sanitary service of the plantations on the east coast of Sumatra is taking against mortality among the children of the coolies. Monthly inspections have been carried out for several years. The results are as yet unsatisfactory, infant mortality ranging from 17 per cent. to 26 per cent. Recently the Deli Maatschappij started a new experiment by opening child clinics on six plantations. A special nurse every day visits one clinic, her working program being as follows : general medical inspection of all the children, weighing of the babies, treatment of skin diseases, making blood smears for malaria control. In case of disease the child is taken to the central hospital for examination by a physician : if necessary treatment in the hospital follows. After the clinical work is done, the nurse has to visit the coolies' houses for control and sanitary education. This latest sanitary measure is the first attempt of decentralization after long years of successful centralization of hygienic work on the plantations.

SONDAG (A. V. A.). Notes sur la pathologie syrienne. [**The Diseases of Syria.**]—*Arch. Méd. et Pharm. Milit.* 1930. Nov. Vol. 93. No. 4. pp. 493–513. With 2 charts in text.

The author has had 4 years' hospital practice at Aleppo. The commonest disease in that district is three-day-fever, which hardly anyone escapes. Relapses are not rare and occur at longer and longer intervals; e.g., the author had 4 attacks, the 2nd after 5 months, the 3rd after 10, and the 4th after 23. The only complications seen are asthenia and loss of hair lasting for 3 months. Several pages are devoted to malaria and its protean forms but the kind is not stated. Amoebic dysentery comes third in frequency; it has been diagnosed in nearly all cases by stool examinations, supported in doubtful cases by staining by iron haematoxylin or inoculation into the kitten's rectum. Bacillary dysentery is stated to be very rare. Amoebic hepatitis is often seen and also amoebic abscess of the lung. Pneumonia is frequent in the army owing to the presence of Malagasies and Senegalese. It is systematically treated by antipneumococcic serum injected intravenously on two successive days and the mortality is given as 5 per cent. [numbers not stated]. Aleppo button comes next. The author comments on the number of remedial agents and points out that after a year cure tends to be spontaneous. Enteric fevers are not common, thanks to vaccination. Typhus is decidedly rare and dengue unusual. The author, who had an attack of dengue, suffered from extreme hyperaesthesia of the hairy scalp.

A. G. B.

GOODNER (Kenneth) & SHATTUCK (George Cheever). **Water in Relation to the Endemic Diarrheas in Yucatan.**—*Amer. Jl. Trop. Med.* 1930. Nov. Vol. 10. No. 6. pp. 427–433. [2 refs.]

The present article is preliminary to a full report which is in preparation. It tells the story of a population living under conditions of almost total neglect of sanitation with a heavy incidence of intestinal infections. That these are not milk-borne seems to follow at once from the statement that very little milk is used in Yucatan. The water supply therefore comes under suspicion. Water is obtained largely from roof supplies but more commonly from wells. The wells are often near a cesspool and apparently receive abundant surface and soil water with little filtration. The yards of houses are used for defaecation. In the year 1924 there were in Merida, Yucatan, 646 deaths under 5 years from diarrhoea, enteritis and dysentery, to 1,075 deaths from all causes at this age period. The same proportions at all ages were 1,085 to 2,512. Bacteriological examination of water samples afforded direct evidence of high contamination. Practically every sample contained lactose fermenters, often more than 10 per cc. In a population such as this money could not be found to safeguard the wells from contamination. Preventive measures therefore should be directed to insistence on the importance of cleanliness of water containers and above all on the necessity for boiling all water.

W. F. Harvey.

CORPUS (Teofilo). **The Problem of the Campaign for the Construction of Adequate Toilets in the Control of Cholera, Dysentery, Typhoid Fever, and Gastroenteritis.**—*Jl. Philippine Islands Med. Assoc.* 1930. June. Vol. 10. No. 6. pp. 245–247.

In spite of there being laws and regulations in Manila regarding conservancy, sewage disposal, and the necessity for buildings to be

provided with privy accommodation, in the Meisic district 20·6 per cent. of thirteen thousand houses inspected had no such provision of any kind and another 53·5 per cent. used public midden sheds. It is hardly a matter for wonder, therefore, that the incidence of intestinal diseases is high. Among 129,181 inhabitants there were, in 11 months of 1929, 200 cases of dysentery with 76 deaths, 138 of enteric fever with 27 deaths, and 192 cases of "gastroenteritis," all but one fatal. [It would be interesting to know the nature of this most fatal form of gastroenteritis; was it perhaps cholera?] The remedy would seem to be obvious—to allow no buildings to be erected, or at all events used, unless adequate means of dealing with excreta are provided—but many of the inhabitants are so poor that they cannot afford even a bucket. These should be given them by the sanitary authorities. Naturally, the usual measures for control of infective diseases by the health authorities would also have to be put in action.

H. H. S.

FORT (M. A.). **A Satisfactory Sanitary Privy costing a Dollar and a Half.** —*Southern Med. Jl.* 1930. Nov. Vol. 23. No. 11. p. 1037.

As a result of his experience with a rural population the author of this article found that privy risers constructed of wood rarely lasted more than twelve months and generally became dilapidated and gave rise to nuisance even before the expiration of that short time.

That a privy riser should be cheap, effective, and at the same time well nigh indestructible, and that a wooden riser is none of these things everybody with experience will agree.

The riser devised by Dr. Fort is cast in concrete. It is 1½ inches in thickness, tapering in vertical section (internal measurements 11 inches square at the top, and 15 inches square at the bottom) and of sufficient height to permit of its passing well down below ground level.

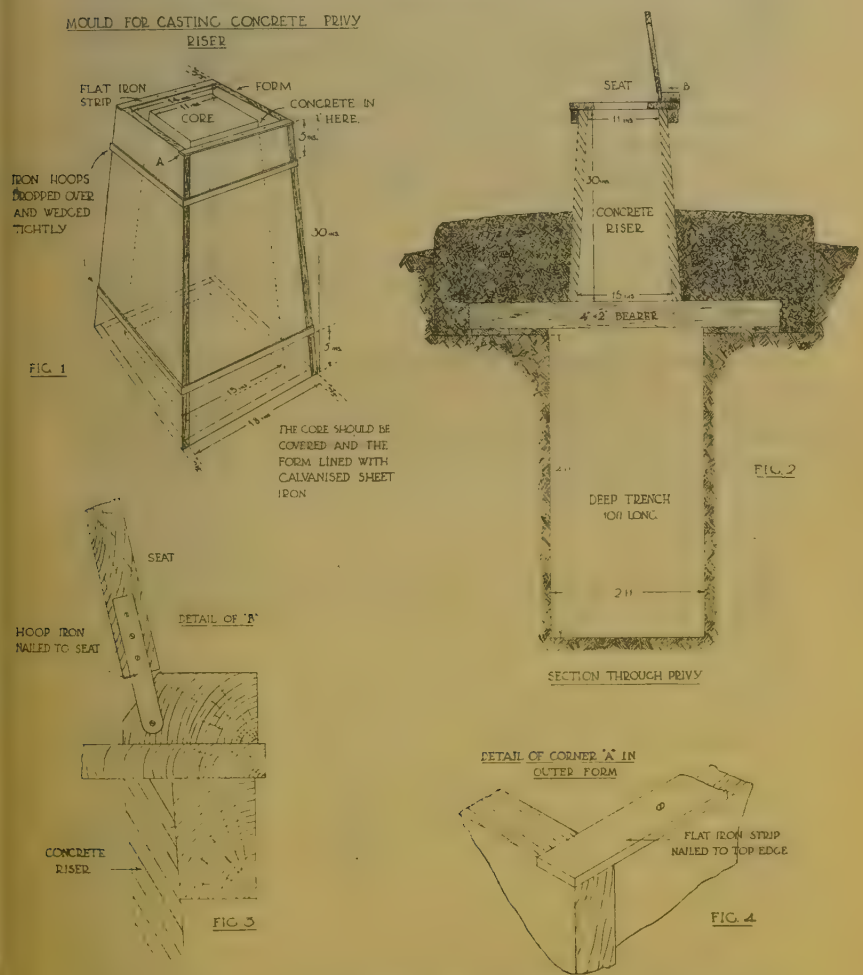
"The wooden forms for holding the concrete for this privy riser are made of plank ¾ inch thick. First, make a central core for the form, 11 inches square at the top, 15 inches square at the bottom, 30 inches high and covered with galvanized iron sheeting, smooth. Then make four sides for the outside form. Opposite sides, 1 and 3, are 14 inches wide at top, 18 inches wide at bottom. Both top and bottom are strengthened by a flat iron strip, horizontal, which protrudes ¾ inch beyond the edge at each side. The other two sides, 2 and 4, are 1½ inches wider than sides 1 and 3, and are made in the same way, except iron strips do not protrude beyond edges. All lined with galvanized iron sheeting. When they are stood together sides 2 and 4 lap over edges 1 and 3, forming a hollow frustum of a pyramid, 14 inches square at the top, 18 inches square at the bottom, internal measurements. The protrusions on sides 1 and 3 prevent their falling in. Two square iron hoops are made, the larger going over form down to 5 inches from the bottom, where it becomes tight. The other hoop tightens 5 inches from the top. Grease the central core and outside form and drop the assembled form over the core, mix and pour the concrete. Next day, lay 2 by 4's under opposite edges, tap central core until it drops out, loosen iron hoops, remove sides, revealing concrete riser with walls 1½ inches thick, 14 inches square at the top, 18 inches square at bottom, outside measurements, 30 inches high.

"To make seat, 4 pieces, 1½ inches by 1½ inches, are cut and nailed into a square fitting snugly over top of riser; like a hat. This is floored over, the hole is cut, and the lid fastened on.

"*Installation.*—We dig a pit 10 feet long, 5 feet wide, 1 foot deep. Then we dig longitudinally in the bottom of this pit a second pit 10 feet long,

2 feet wide, 4 feet deep. (In some perfectly loose soils this pit must be curbed.) Two iron bars, iron pipe, fat rails or scantlings are placed across the deep pit and the riser placed on these. The deep pit is covered with non-rotting material, such as fat plank, rails, concrete, terra-cotta or iron slabs, or other waste material from the junk heap. Then fill in and pack dirt in shallow pit, having dirt over the entire area higher than surrounding land to shed water perfectly. The privy floor may be sand, clay, wood or concrete."

The mould is illustrated in the accompanying drawing Fig. 1 and the finished riser in situ in Fig. 2. Beyond the suggestion that the riser



The "Mosaic Law" Privy.

[From drawings prepared in the Division of Public Health, London School of Hygiene and Tropical Medicine, by Mr. L. Kluth.]

might be rendered less liable to become foul in use if the dimensions from back to front were increased to 13 inches at the top and 20 inches at the bottom, there can be little but commendation for Dr. Fort's idea.

Concrete can be made everywhere with local material, and by unskilled labour. It is claimed that this type of privy may be provided at the cost of a dollar and a half. Given the mould—in which of course any number of risers may be made—the claim is probably quite justified.

As will be seen from the drawing, Fig. 2, the riser enters 12 inches into the ground. By this means a solid footing is obtained for the bearers, a permanently sound joint secured between riser and trench, and the latter is safeguarded against surface water flooding.

A simple type of hinge for use on the seat lid is illustrated in the detail drawing, Fig. 3. The reliability of this device has been proved in practice. It is easily improvised—a piece of hoop iron and a few screws being all that is necessary for its construction.

The drawing, Fig. 4, illustrates an important detail in the construction of the outer form of the casting mould.

H. H. Clay.

BOUCHER (Humbert). Les maladies des coloniaux observées à Vichy. [**Diseases of Tropical Residents seen at Vichy.**]—*Rev. Prat. Malad. des Pays Chauds.* 1930. Nov. Year 9. Vol. 10. No. 11. pp. 521–529.

——. **Tropical Diseases observed at Vichy.**—*Jl. Trop. Med. & Hyg.* 1931. Apr. 1. Vol. 34. No. 7. pp. 97–99.

The author gives figures for a period of 6 years, 1924–29, a total of 523 persons, treated at Vichy, 408 men and 115 women. The majority were from the tropics, the rest from the subtropics. Three were considered unsuited for the cure. Of the 520 17 per cent. of cases were diagnosed as malaria [no mention of the microscope], 15 per cent. as "hepatisme," 6 per cent. as dysentery, 1 per cent. as sprue. All the patients had been abroad for at least 2 years. The small figure for sprue is attributed to the progress of therapeutics and hygiene in the French colonies. Malarial patients get quinine as well as Vichy water. All appear to have done well.

A. G. B.

CASTELLANI (Aldo). **Minor Tropical Diseases.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1931. Jan. 31. Vol. 24. No. 4. pp. 379–412. With 5 plates, 4 charts & 2 text figs. [22 refs.]

The author considers his subject under the headings—Climatic Diseases—Fevers—Internal Diseases—Diseases of Organs of Specal, Sense—Diseases of Skin and Hair; the last occupies 28 pages. The illustrations are good. The mass of information cannot be reviewed.

A. G. B.

REVIEWS AND NOTICES.

PROGRÈS DE L'ALUMINIUM. VIII. **Sanitary Problems in Tropical Bauxite Mines.**—pp. 3–35. With 1 map & 21 figs. [1931.] Geneva: Aluminium Limited, 59 Rue du Stand. [Summary appears also in *Bulletin of Hygiene.*]

This attractive brochure is No. 8 in a series the previous numbers of which dealt with aluminium in its industrial aspects. The writer of the introduction states that Aluminium Ltd. through its subsidiary, Demerara Bauxite Co. Ltd., has developed in British Guiana a centre for the study and treatment of tropical diseases under the direction of Dr. George GIGLIOLI and Dr. Cesare ROMITI. The results of this work, he rightly says, are of interest to circles far beyond the limits of an industrial undertaking. The pamphlet consists of papers on Some general characteristics of British Guiana in relation to medical and sanitary work (GIGLIOLI); Malaria in British Guiana; its symptoms and effects (GIGLIOLI); Some observations on malaria control with special reference to conditions in the interior of British Guiana (GIGLIOLI); Important diseases in British Guiana other than malaria, such as filariasis, hookworm, and enteric fevers (GIGLIOLI); Use of bamboo in subsoil drainage (J. JACK, A.R.San.I.); The Mackenzie hospital (ROMITI); Drinking and domestic water supply at Mackenzie, British Guiana (GIGLIOLI). Naturally it contains little that is new to *Bulletin* readers. The following may be commended as a reasonable account of the benefit to labour of hookworm treatment:—

"'We started mining ore at Three Friends on the 13th of January 1923, and at that time our miners were loading 3·6 tons of ore per man per ten-hour day. At the end of 8 months' training, I find that this amount has only been increased to 5 tons per man per ten-hour day. In September 1923, you tried the carbon tetrachloride treatment for hookworm on these miners. Of course, I see no change in the tonnage mined per man in September or in October, but in November, I note that this went to 5·1 tons per man per ten-hour day; in December it increased to 5·15 tons per man per ten-hour day; in January 1924, our output per man per ten-hour day was 5·6 tons; and in February to date, our output is 6·76 tons per man per ten-hour day.'

"'In the beginning of 1923, 96 miners on the ore face were mining 342 tons of bauxite per working day, whereas, on the 1st February 1924, 76 miners at the ore-face are mining 540 tons of bauxite per working day. I cannot say I attribute this increase in the output of ore per man per day entirely to the treatment which you gave for hookworm, but I do think that, to a great extent, the elimination of this disease has had something to do with our increased output and our reduction of costs. For the 5 months previous to September 1923 the increase in tonnage per man per day was nil, whereas, during the 5 months following September 1923, our increase in tonnage has amounted to 1¾ tons per man per day.'"

Giglioli notes that the cost of treatment per man was 0·0075 dollar.

Another worth-while quotation is this—

"When the Mackenzie plant was being constructed, provision was made for the building of a filtration and chlorination plant to deal with the Demerara River water. The construction of this plant was actually begun, and at no mean cost. In 1923 the writer, finding that there was no reason to warrant further expense on the construction and operation of this plant, recommended that its construction should not be continued. This opinion has only been confirmed by seven years of further observation and research. . . . At Mackenzie, as conditions exist at present, the risk of contamination of the water supply is practically nil. Under the circumstances, to spend large sums of money on filtration and chlorination

equipment would be an eminently wasteful operation," with the corollary "Stereotyped sanitation, even if based on the most orthodox methods, is bound to be wasteful."

The pamphlet is attractively illustrated.

A. G. B.

CALCUTTA. **Annual Report of the Calcutta School of Tropical Medicine, Institute of Hygiene and the Carmichael Hospital for Tropical Diseases 1930** [ACTON (Hugh W.), Director].—131 pp. With 1 plate & 1 chart. 1931. Calcutta: Bengal Govt. Press.

This report presents a very useful survey of the work which is being carried on in the most important overseas centre of education and research in tropical diseases. The general impression left on the reader is that the staff is engaged at high pressure and with the usual insufficiency of assistance in research of a highly important character and of wide range. A review of the manifold activities of the Calcutta School can only pick out a few points for specific notice. Fortunately it is unnecessary to do more, as most of the work done has been or is about to be published in journal form.

The investigation on filariasis, with its problems of causation and symptomatology, provides interesting reading. A rough rule is enunciated that "persons harbouring microfilariae in their blood rarely show signs of elephantiasis and conversely cases of elephantiasis rarely show microfilariae in their blood." The reason is dependent on the mode of production of the elephantiasis, for it is only so long as there is no lymphatic obstruction that microfilariae can get into the blood stream. The acute inflammatory phenomena which play so large a part in the production of changes other than mere lymphatic obstruction have been traced invariably to some septic focus and settlement of organisms in the area where locally the resistance of the tissues to infection is greatly lowered. The proof of this, more or less already known fact, is afforded by finding the same causative organism in the septic focus, in the inflammatory area and in the urine. The high incidence which may be reached in this disease and also its variability in different districts are apparent in the recorded statement of the presence of microfilariae in the blood of every third person in Cochin and in every tenth person in Allahabad. It is not the person who is suffering from elephantiasis who is a danger to the community but the commonly occurring carrier, who shows no symptoms at all.

Epidemic dropsy is contrasted with beriberi in its relation to rice eating. The former is not a deficiency disease and is not curable by administration of vitamin B preparations, but may be prevented if care is taken that the rice eaten is not diseased.

Spirochaetal infections have been specially investigated and perhaps the most important pronouncement in this case, with avian spirochaetosis and its cause *Spirochata anserina* as exemplification, is that no ultra-minute and invisible granule or spore phase is evident in the life history of these spirochaetes. "Hereditary transmission occurs in the tick probably through the entry of very minute spirochaetes into the ova *in situ*. In the tick transmission is usually via the salivary glands and the tick bite is infective; the tick is also extremely infective if swallowed."

Two further points in this interesting survey of the year's work may be referred to briefly. The first of these relates to research on ringworm fungi and may possibly have a wide application in this group of infections—"The different lesions due to dhobie itch (Tinea cruris) are all due to one fungus which varies in colour and morphological appearances." The second is a simple note of a useful microscopic method for the differentiation of skin diseases instead of the caustic potash clearing method. The stain has the composition :—toluidin blue 1; acetic acid 2; absolute alcohol 4; water 100. A few drops are placed on the test scales or the bit of skin

and a cover glass applied. If the material is too deeply stained the cover glass is lifted off, excess of stain removed by blotting paper, and a few drops of glycerin added to clear the tissue, by which means the character of the scales and the presence of fungi are demonstrable under high powers.

Various reports are included in this publication from the different departments which go to make up the School of Tropical Medicine, the Institute of Hygiene, the research sections and the Carmichael hospital.

W. F. Harvey.

GHOSH (Birendra Nath) [F.R.F.P. & S. (Glasg.), etc.]. **A Treatise on Hygiene and Public Health with Special Reference to the Tropics.** Revised and largely rewritten with the Advice and Assistance of A. D. STEWART [M.B., etc.]. Seventh Edition.—pp. xxvi+728. With 149 text figs. 1930. Calcutta: Scientific Publishing Co. [Rs. 6–8 or 10s. 6d.] [Review has appeared also in *Bulletin of Hygiene.*]

Since the first issue of this work under the joint authorship of Dr. B. N. Ghosh and Dr. J. L. DAS in 1912, there has been a new edition on an average every 3 years, the seventh being published in October 1930. Dr. Ghosh has alone been responsible for the last three issues. A work so successful as this calls for little in the way of review; the steady issue of new editions is of itself sufficient evidence of its worth. Opportunity has been taken to bring the subject up to date, but by judicious cutting down of old material the author has been able to make several important additions and improvements without increasing unduly the size of the book, which remains a manual in the English sense of the term. The whole has been increased by 60 pages, and by the incorporation of 27 new diagrams; nevertheless the price has been kept the same as before. The chief changes from the sixth edition consist in an inclusion in Chapter V of an interesting account of the Physical Geology of India; in Chapter XVI a section on Heredity and Eugenics has been added, and in Chapter XXI Trypanosomiasis and Dysentery, which were absent from previous editions, have now been included and some additions have been made to the chapter dealing with animal parasites. Lastly, the chapter on Vital Statistics has been rewritten and the terminal chapters have been rearranged so that Village Sanitation and the Sanitation of Fairs and Religious Festivals now precede that on Vital Statistics which fitly ends the volume. The author is to be congratulated on so ably incorporating new work without increasing to any appreciable extent the size. Due acknowledgment is made to Major G. COVELL, I.M.S., of the Malaria Survey of India, who has rewritten the part dealing with Malaria, and to Colonel A. B. FRY, I.M.S. (retd.), and Lt.-Colonel A. D. Stewart, I.M.S., for their help in the revision.

H. H. S.

VAN ASSENDELFT (F.). **Impfmalaria.** [Induced Malaria.]—*Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* 1931. Vol. 35. No. 1. pp. 1–104 (1–104). With 62 text figs. 1931. Leipzig: J. A. Barth.

An academic thesis for the degree of doctor of medicine at Amsterdam University. It is a clinical study of 350 cases of induced benign tertian malaria in patients who underwent malariotherapy in mental hospitals in Amsterdam. The infection was induced by the direct inoculation of blood subcutaneously or (in a few instances) intravenously. Charts of temperature and parasite counts in six cases infected by mosquito bites are also given. The author states that in preparing the thesis he was assisted by Professor SCHÜFFNER and Dr. P. C. KORTEWEG, who had previously studied many of the cases. The principal observations recorded are concerned with (1) the duration of the incubation period, (2) the "injection

fever," which occurs shortly after inoculation, (3) the " initial fever " which, in primary cases, ushers in the onset of the malarial attacks, (4) the type of fever (quotidian or tertian) of the malarial attack. KORTEWEG's description of the initial fever and of the resemblance between the type of fever in the donor and recipient are confirmed as well as his observation that asexual parasites in all stages of development can be found in " thick drop " preparations of blood taken during the incubation period before the first rise of fever. The " pyrogenic limit " of parasites is very different in different cases and at any given period of the malarial attack it is difficult to correlate the parasite count with the height of the fever. Absence of relapses is the chief difference between inoculated and natural malaria and the view that there are strains of inoculated malaria without sexual forms of the parasite in the blood is not in accordance with experience in Amsterdam.

S. P. James.

VAN CLEAVE (Harley Jones) [Professor of Zoology, University of Illinois]. **Invertebrate Zoology.** Second Edition.—pp. xiv+282. With frontispiece & 126 text figs. 1931. London & New York: McGraw-Hill Book Company, Inc. [$3.00.]

Of the 261 descriptive pages of this volume 211 are assigned to invertebrate animals and 50 are occupied with certain generalities of wider range, such as classification, cell and tissue differentiation, reproduction and the beginnings of the embryo, and phylogeny. Of the 211 pages 120 are allotted to the four groups or phyla that come within the special range of this *Bulletin*, namely Protozoa (39 pp.), Platyhelminthes (22 pp.), Nemathelminthes (9 pp.), and Arthropoda (50 pp.). In the treatment of the subject a general account is given of each phylum and of each of its constituent Classes and sub-classes, typical forms—adult or larval—and characteristic structures are described and perhaps figured in illustration, and the taxonomy of the phylum is outlined in a synopsis that comprises nutshell definitions of Orders with bare names of their representative genera.

In the chapter on Protozoa the concept of the single self-centred animal cell, with some compromising holophyte connexions, yet with some Metazoan aspirations (shown in purposeful agglomerations and slightly differentiated colonial forms, differentiated gametes, and differentiation of the cell-plasm to form organidia) is instructively considered. In the 26 text-figures of characteristic forms six of those parasitic in man appear, and are briefly noticed. What is wanting is a little guidance towards natural sources of material and in technical methods of studying this so variously attractive crowd of animalcules.

In the two chapters allotted to the Platyhelminthes and Nemathelminthes the familiar life-histories of the liver-fluke and the ox-tapeworm are described, and Ascaris and hookworm and the notorious Trichinella are brought forward. But from both groups there are many important omissions, whether the design of the book be educative or merely informative. Among striking omissions are the discovery by JANICKI and ROSEN of the procercoid stage of the ribbon worm in the wide-ranging *Cyclops strenuus* (and another Cyclopid) and of the subsequent plerocercoid stage in certain freshwater fishes, and so, at last, the completion of the life-cycle of *Dibothriocephalus latus*; the dissolution by OKUMURA, YOSHIDA, and others of the perplexing " genus " Ligula in larval stages of Dibothriocephalus; FEDSHENKO's discovery of the intermediation of Cyclops in the larval development of the guineaworm; and MANSON's discovery of the larval history of *Filaria bancrofti* in certain house-haunting mosquitoes —a discovery which, although criticized at the outset and then left in limbo for many years, at length, in MANSON's fostering care, worked like the leaven which the woman of the Scriptures took and hid in three measures of meal.

The Arthropoda are confined within fifty pages, of which Crustacea take twenty and Insects are rather hardly treated in seventeen, all that is diffidently proffered on the importance of insects in Nature and in human affairs barely filling one page, though for this laconic necessity the author is apologetic.

It is not easy to place this book. It does not carry much farther than the elements of zoology, and yet the author states that "an introductory course in college zoology is assumed as a pre-requisite to a course for which this book is designed as a text." It does not lend any special impetus to the practical applications of zoology; nor on the other hand does it particularly point the way to those interesting biological and philosophic studies that show the priceless value of zoology in the real education that leads Man to knowledge of himself and his place in Nature. The book may be described without any intended disparagement as a good compendium that will be appreciated by men who are preparing to meet that incalculable abstraction, the examiner.

A. Alcock.

NÖLLER (Wilhelm). **Die nächsten Verwandten der Blutflagellaten und ihre Beziehungen zu den blutbewohnenden Formen.** [The Nearest Relatives of the Blood Flagellates and their Connexions with the Blood Forms.]—*Handbuch der Pathogenen Protozoen.* (Prowazek-Nöller.) 1931. Bd. III. Lief. 13. pp. 1969–2143. With 28 text figs. Index to Bds. I–III. pp. 2144–2171. 1931. Leipzig: J. A. Barth. [32 Rm.]

In 1911 was issued the first part of a treatise on the pathogenic protozoa under the editorship of Professor S. von PROWAZEK, who saw the completion of the first volume in 1912 and two parts of the second in 1912 and 1914. His death from typhus fever during the War and the conflict itself interrupted the issue for six years, the third and final part of the second volume not appearing till 1921 under the editorship of Professor Wilhelm Nöller. Three further parts were published in 1921, one in 1925, and another in 1928, and now the thirteenth part completes the treatise which has covered a period of twenty years. It will be evident that the various parts, written by different authors, one of whom was Karl BELAR, whose recent death as the result of a motor accident is such a serious loss to protozoology, are of very unequal worth from the present day point of view, the earlier ones being more of historical than of any other value. The twelfth part was by Professor Nöller, and dealt with the cultivation of parasitic protozoa, while the final part now being considered is by the same author and discusses the nearest relatives of the blood flagellates and their relationship to the blood-inhabiting forms. Under this title the author first deals with various intestinal flagellates such as *Trichomonas*, *Hexamita*, and *Lamblia*, which may occur in the blood stream, invasion having taken place shortly before or after death of the host; next with the Bodonidae including *Bodo* and *Prowazekia* which appear coprozoically in faeces and possibly in the intestine itself and *Cryptobia* and its allies *Trypanophis* and *Trypanoplasmoides* which are parasitic in invertebrates, chiefly molluscs, or in the intestine and blood of fish; and finally with the *Herpetomonadidae* which embrace all the flagellates commonly known as insect flagellates, leishmania and trypanosomes.

The book covers very much the same ground as similar articles which have appeared in several text books in recent years, and it is evident that these have been consulted and to a large extent followed. The general arrangement is inevitably the same but the author has introduced modifications of his own, as for instance in the classification where a series of sub-genera has been established. Of the *Herpetomonadidae*, the account of which occupies the bulk of the book, there are three main divisions, viz.: forms without undulating membrane (*Leptomonas* and *Herpetomonas*),

forms with rudimentary membrane (*Rhynchoidomonas* and *Cystotrypanosoma*) and forms with completely developed membrane (*Crithidia* and *Trypanosoma*). The genus *Leptomonas* includes the sub-genera *Leptomonas*, *Phytomonas* and *Leishmania* together with *Cercoplasma*, the position of which in the scheme of classification adopted seems anomalous as members of the sub-genus possess both leptomonad and trypanosome stages. The genus *Herpetomonas* is based chiefly on the tendency of the house fly flagellate to possess two flagella, though most authorities consider that the bi-flagellate condition merely indicates that division is in progress. The position in an intermediate group with rudimentary membrane of *Rhynchoidomonas* and *Cystotrypanosoma* raises questions which cannot be discussed here. It will be sufficient to state that both these include forms which are essentially trypanosome in type, while the latter has representatives which are supposed to undergo encystment, a feature originally attributed by MINCHIN to *Trypanosoma grayi*. In the case of this trypanosome it is now known, from the work of HOARE, that the supposed cysts are merely artefacts, an observation which throws considerable doubt on the validity of the genus *Cystotrypanosoma*, the establishment of which by ROUBAUD was based largely on the supposed cysts of *Trypanosoma grayi*. It is far from clear why the author did not include in this intermediate group *Cercoplasma* with its trypanosome stages. It must be admitted, however, that the affinities of these purely insect flagellates with both leptomonad and trypanosome stages are very obscure. In the third group are *Crithidia* and *Trypanosoma* with sub-genera *Schizotrypanum* and *Endotrypanum* and here the author is on firmer ground. It is noted that certain flagellates previously regarded as *Crithidia* in insects have been shown to be insect phases of vertebrate trypanosomes and that the retention of the genus is only justified by the fact that in many cases a trypanosome phase has not yet been discovered.

The trypanosomes proper are considered from the point of view of their transmission and those of fish, amphibia, reptiles, birds and mammals are discussed separately. The trypanosomes of mammals again are described in sections determined by the invertebrate transmitter rather than by the type of development followed by them. Thus there are sections devoted to bug-transmitted trypanosomes, flea-transmitted trypanosomes, tsetse-transmitted trypanosomes and so on, while the case of *Trypanosoma equiperdum*, in which no insect is involved, is considered separately. In the last section the origin of trypanosomes is discussed and the conclusion is reached that the view enunciated by LÉGER in 1902, that they have sprung from original insect flagellates, is the correct one. Considerable space is devoted to refutation of the theory first put forward by MINCHIN in 1908 that the blood-inhabiting trypanosomes may have originated from intestinal flagellates of vertebrates, the author evidently being unaware that MINCHIN himself subsequently reverted to LÉGER's hypothesis.

Such, in brief outline, is the subject matter of the book which, though possibly open to criticism from the point of view of classification and a few minor details, maintains a high standard throughout as regards accuracy of detail and clearness of exposition. The illustrations are adequate, while a series of lists of insect and other flagellates and their hosts is of value for purposes of reference. There are forty pages of bibliography and a short appendix dealing with publications which appeared too late for reference in the main text, which was completed in December 1930. The author is to be congratulated not only for having produced an excellent account of the trypanosomes and allied flagellates, but also for bringing to a successful conclusion Prowazek's handbook of pathogenic protozoa and in removing a constant source of annoyance by supplying an index to the thirteen parts which make up the three volumes.

C. M. Wenyon.